PM7350

S/UNI-DUPLEX™

S/UNI-DUPLEX

DUAL SERIAL LINK, PHY MULTIPLEXER

DRIVER MANUAL

PRELIMINARY

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REVISION HISTORY

Issue No.	Issue Date	Originator	Details of Change
Issue 1	July 1999	James Lamothe	Document created from S/UNI-DUPLEX Driver Design Spec (PMC-981033 Issue 2) and the S/UNI-VORTEX Driver Manual (PMC-990786 Issue 1)

ABOUT THIS MANUAL

This manual describes the S/UNI-DUPLEX device driver. It describes the driver's functions, data structures, and architecture. This manual focuses on the driver's interfaces to your application, real-time operating system, and to the S/UNI-DUPLEX device. It also describes in general terms how to modify and port the driver to your software and hardware platform.

Audience

This manual was written for people who need to:

- Evaluate and test the S/UNI-DUPLEX device
- Modify and add to the S/UNI-DUPLEX driver's functions
- Port the S/UNI-DUPLEX driver to a particular platform.

References

For more information about the S/UNI-DUPLEX driver, see the driver's release notes. For more information about the S/UNI-DUPLEX device, see the following documents:

- S/UNI-DUPLEX (Dual Serial Link, Phy Multiplexer) Datasheet: PMC-980581
- S/UNI-DUPLEX (Dual Serial Link, Phy Multiplexer) Short Form Datasheet: PMC-990174)
- S/UNI-DUPLEX and S/UNI-VORTEX Technical Overview: PMC-981025

Note: Ensure that you use the document that PMC_Sierra issued for your version of the device and driver.

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1 DRIVER PORTING QUICK START

This section summarizes how to port the S/UNI-DUPLEX device driver to your hardware and operating system (OS) platform.

Note: Because each platform and application is unique, this manual can only offer guidelines for porting the S/UNI-DUPLEX driver.

The code for the S/UNI-DUPLEX driver is organized into C source files. You may need to modify the code or develop additional code. The code is in the form of constants, macros, and functions. For the ease of porting, the code is grouped into source files (src) and include files (`inc`). The `src` files contain the functions and the `inc` files contain the constants and macros.

To port the S/UNI-DUPLEX driver to your platform:

1. Port the driver's OS extensions (page 98):
   - Data types
   - OS-specific services
   - Utilities and interrupt services that use OS-specific services
2. Port the driver to your hardware platform (page 100):
   - Port the device detection function.
   - Port low-level device read-and-write macros.
   - Define hardware system-configuration constants.
3. Port the driver's application-specific elements (page 102):
   - Define the task-related constants.
   - Code the callback functions.
4. Build the driver (page 103).

For more information about porting the S/UNI-DUPLEX driver, see section 7.

2 DRIVER FUNCTIONS AND FEATURES

The following table lists the main functions and features offered by the S/UNI-DUPLEX driver. You can alter these functions by modifying or adding to the driver's code.

Table 1: Driver Functions and Features

Functions	Description
Device Addition and Deletion (page 45)	These functions perform the following tasks: • Reset new devices • Allocate and initialize memory that will store context information for new devices • Deallocate device context memory during device shutdown
Device Initialization (page 49)	These functions initialize the S/UNI-DUPLEX device and its associated context structures.
Device Diagnostics (page 53)	These functions write values to registers and read them back to verify the microprocessor's input and output interface with the device. They enable and disable internal and external loopback for the S/UNI-DUPLEX device's high-speed serial (HSS) interfaces. They also monitor the device's clocks.
HSS Link Configuration (page 56)	These functions configure the HSS links of the S/UNI-DUPLEX device by programming the HSS link registers according to the parameters specified.
Cell Insertion and Extraction (page 59)	These functions insert cells into, and extract cells from, the S/UNI-DUPLEX device control channels by manipulating the insert and extract FIFO control and status registers.
BOC Transmission and Reception (page 65)	These functions transmit and receive BOC on the HSS interfaces. Writing to the transmit-BOC registers transmits BOC. BOC is received by monitoring the receive-BOC status-registers.

Statistics Collection (page 67)	These functions retrieve the device counts (including cells received, cells transmitted, and errored cells received) for accumulation by the application.
Interrupt Servicing (page 23)	These functions clear the interrupts raised by the S/UNI-DUPLEX device. Then they queue the interrupt status for later processing by a deferred interrupt-processing routine (DPR). The DPR runs in the context of a separate task within the RTOS and takes appropriate actions based on the interrupt status queued for it by the Interrupt Servicing Routine (ISR). In polling mode, the DPR process periodically services the interrupt status.
Indication Callbacks (page 80)	The DPR uses indication callback functions to notify the application of events in the S/UNI-DUPLEX device and driver. These events include the reception of cells in the microprocessor extract cell FIFOs and the reception of valid BOC.

2.1 Driver Architecture

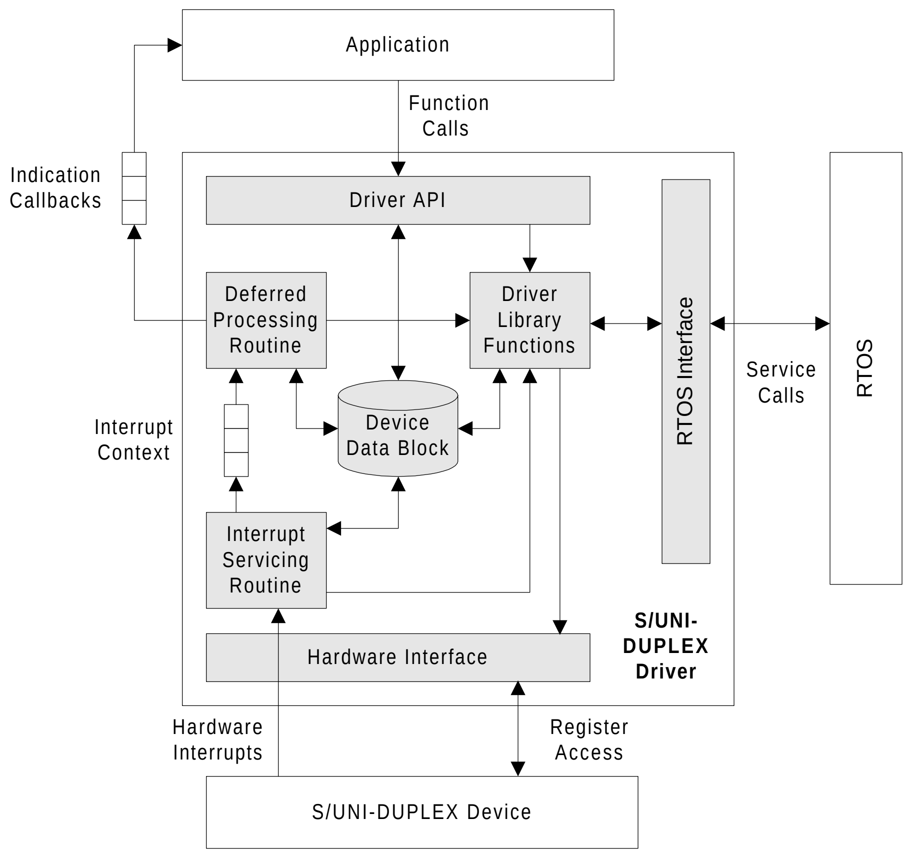
The driver includes seven main modules:

- Driver API module
- Real-time-OS interface module
- Hardware interface module
- Driver library module
- Device data-block module
- Interrupt-service routine module
- Deferred-processing routine module

For more information about these modules, see the following sections.

Figure 1 illustrates the architectural modules of the S/UNI-DUPLEX driver.

Figure 1: Driver Architecture



2.1.1 Driver API Module

The driver's API is a collection of high level functions that can be called by application programmers to configure, control, and monitor the S/UNI-DUPLEX device, such as:

- Initializing the device
- Validating device configuration
- Retrieving device status and statistics information.
- Diagnosing the device

The driver API functions use the driver library functions as building blocks to provide this system level functionality to the application programmer (see below).

The driver API also consists of callback functions that notify the application of significant events that take place within the device and driver, including cell and BOC reception.

2.1.2 Driver Real-Time-OS Interface Module

The driver's RTOS interface module provides functions that let the driver use RTOS services. The S/UNI-DUPLEX driver requires the memory, interrupt, and preemption services from the RTOS. The RTOS interface functions perform the following tasks for the S/UNI-DUPLEX device and driver:

- Allocate and deallocate memory
- Manage buffers for the DPR
- Pause task execution
- Manage semaphores

The RTOS interface also includes service callbacks. These are functions installed by the driver using RTOS service calls, such as install interrupts and start timers. These service callbacks are invoked when an interrupt occurs or a timer expires.

Note: You must modify RTOS interface code to suit your RTOS.

2.1.3 Driver Hardware-Interface Module

The S/UNI-DUPLEX hardware interface provides functions that read from and write to S/UNI-DUPLEX device-registers. The hardware interface also provides a template for an ISR that the driver calls when the device raises a hardware interrupt. You must modify this function based on the interrupt configuration of your system.

2.1.4 Driver Library Module

The driver library module is a collection of low-level utility functions that manipulate the device registers and the contents of the driver's DDB. The driver library functions serve as building blocks for higher level functions that constitute the driver API module. Application software does not normally call the driver library functions.

2.1.5 Device Data-Block Module

The DDB stores context information about the S/UNI-DUPLEX device, such as:

- Device state
- Control information
- Initialization vector
- Callback function pointers
- Statistical counts

The driver allocates context memory for the DDB when the driver registers a new device.

2.1.6 Interrupt-Service Routine Module

The S/UNI-DUPLEX driver provides an ISR called `duplexISR` that checks if there are any valid interrupt conditions present for the device. This function can be used by a system-specific interrupt-handler function to service interrupts raised by the device.

The low-level interrupt-handler function that traps the hardware interrupt and calls `duplexISR` is system and RTOS dependent. Therefore, it is outside the scope of the driver. An example implementation of such an interrupt handler (see page 94) as well as installation and removal functions (see page 93 and page 94) is provided as a reference. You can customize these example implementations to suit your specific needs.

See page 23 for a detailed explanation of the ISR and interrupt-servicing model.

2.1.7 Deferred-Processing Routine Module

The DPR provided by the S/UNI-DUPLEX driver (`duplexDPR`) clears and processes interrupt conditions for the device. Typically, a system specific function, which runs as a separate task within the RTOS, executes the DPR.

See page 23 for a detailed explanation of the DPR and interrupt-servicing model.

2.2 Driver Software States

Figure 2 shows the software state diagram for the S/UNI-DUPLEX driver. State transitions occur on the successful execution of the corresponding transition functions shown. State information helps maintain the integrity of the driver's DDB by controlling the set of device operations allowed in each state. Table 2 describes the software states for the S/UNI-DUPLEX device as maintained by the driver.

Figure 2: Driver Software States

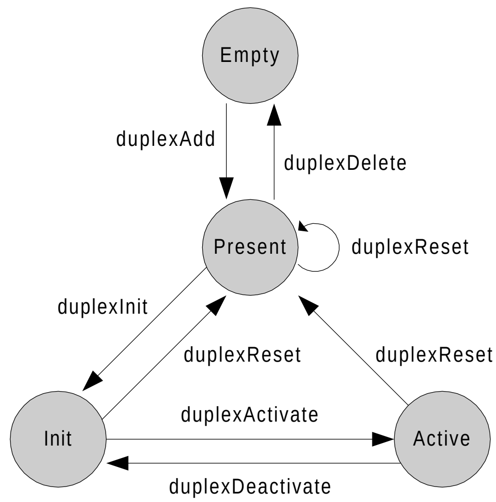


Table 2: Driver Software States

State	Description
Empty	The S/UNI-DUPLEX device is not registered. This is the initial state.
Present	The driver has detected the S/UNI-DUPLEX device and the drive has passed power-on self-tests. The driver has allocated memory to store context information about this device.
Init	An initialization vector passed by the application has successfully initialized the S/UNI-DUPLEX device. The initialization parameters have been validated and the device has been configured by writing appropriate bits in the control registers of the device.
Active	The S/UNI-DUPLEX device has been activated. This means that the device interrupts have been enabled and the device is ready for normal operation.

2.3 Processing Flows

This section describes some of the main processing flows of the S/UNI-DUPLEX driver:

- Device initialization, re-initialization, and shutdown

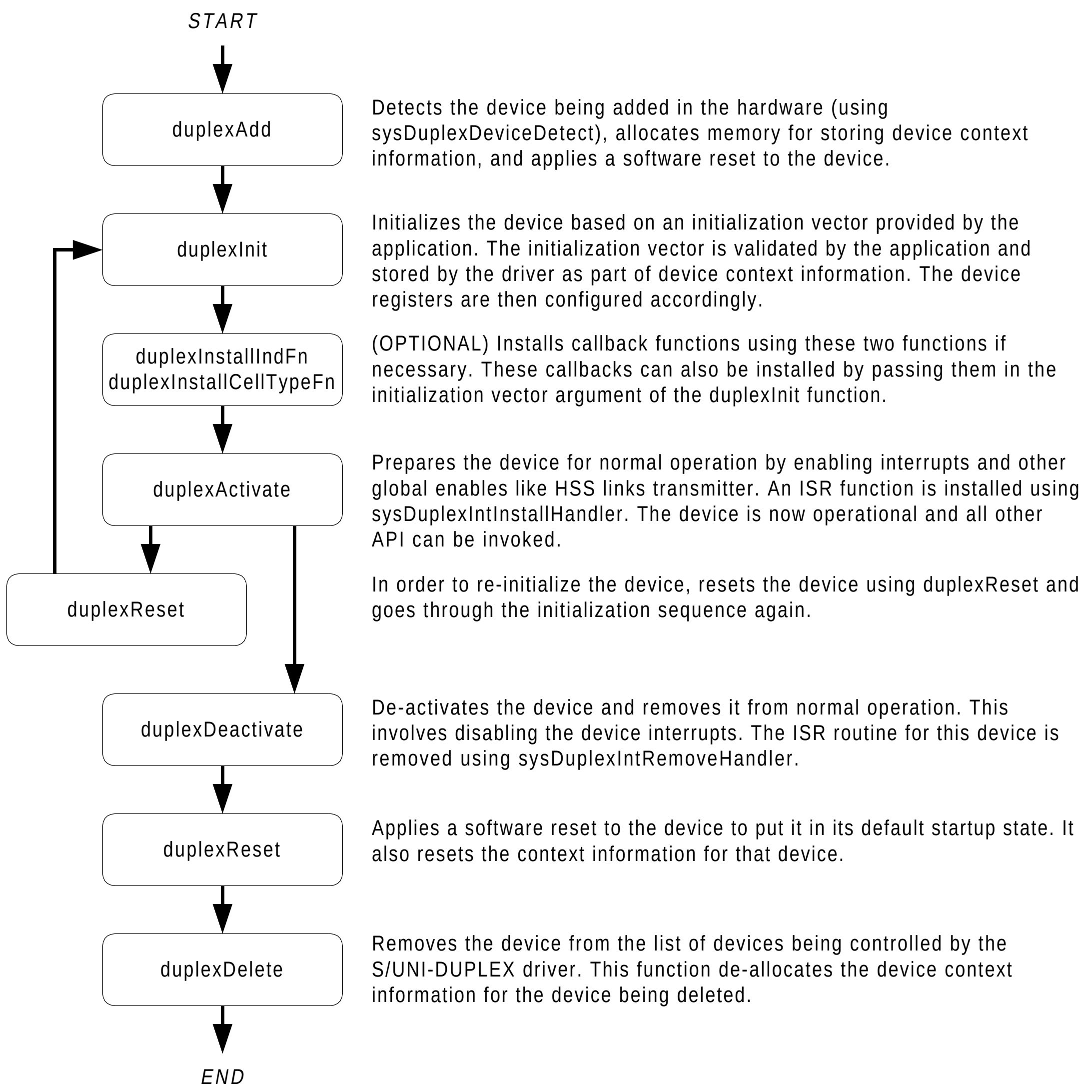
- Cell extraction
- Interrupt servicing
- Polling servicing

The flow diagrams presented here illustrate the sequence of operations that take place for different driver functions. The diagrams also serve as a guide to the application programmer by illustrating the sequence in which the application must invoke the driver API.

2.3.1 Device Initialization, Re-initialization, and Shutdown

The following figure shows the functions and process that the driver uses to initialize, re-initialize, and shutdown the S/UNI-DUPLEX device.

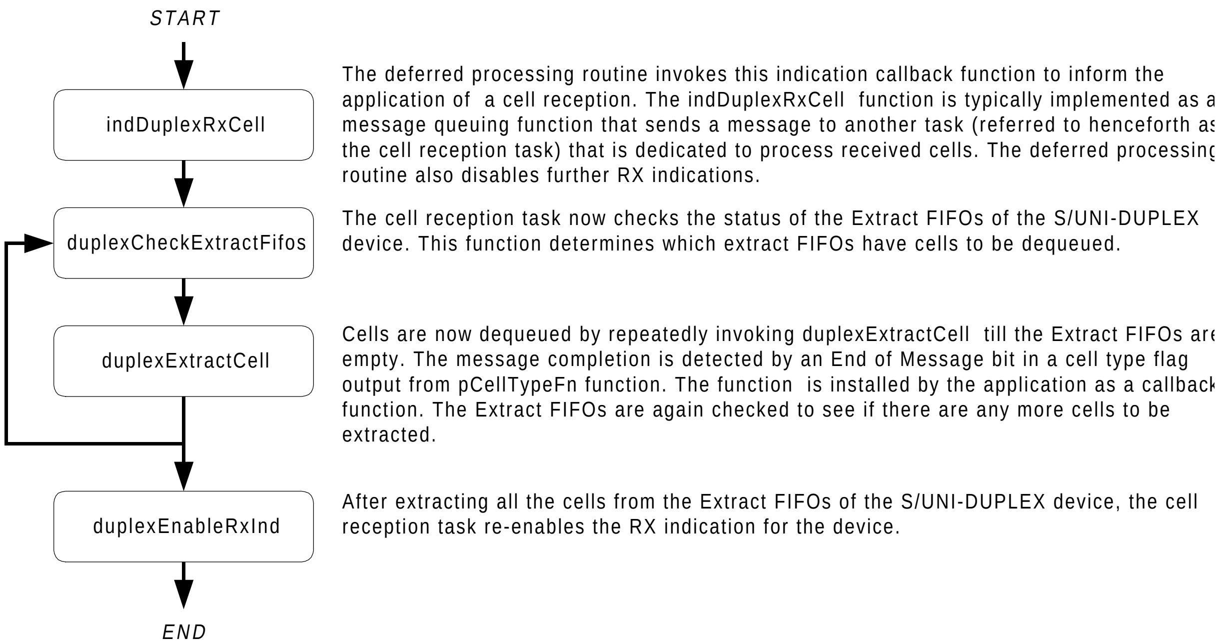
Figure 3: Device Initialization, Re-initialization, and Shutdown



2.3.2 Cell Extraction

The following figure shows the functions and process that the driver uses to extract cells from the S/UNI-DUPLEX device.

Figure 4: Cell Extraction



2.3.3 Interrupt Servicing

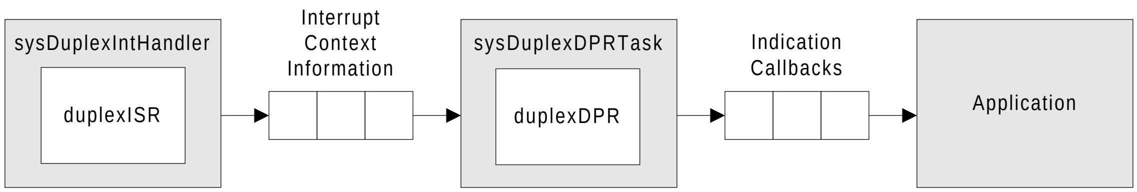
The S/UNI-DUPLEX driver services device interrupts using an interrupt service routine (ISR) that traps interrupts and a deferred interrupt-processing routine (DPR) that actually processes the interrupt conditions and clears them. This lets the ISR execute quickly and exit. Most of the time-consuming processing of the interrupt conditions is deferred to the DPR by queuing the necessary interrupt-context information to the DPR task. The DPR function runs in the context of a separate task within the RTOS.

Note: Since the DPR task processes potentially serious interrupt conditions, you should set the DPR task's priority higher than the application task interacting with the S/UNI-DUPLEX driver.

The driver provides system-independent functions, `duplexISR` and `duplexDPR`. You must fill in the corresponding system-specific functions, `sysDuplexISR` and `sysDuplexDPR`. The system-specific functions isolate the system-specific communication mechanism (between the ISR and DPR) from the system-independent functions, `duplexISR` and `duplexDPR`.

Figure 5 illustrates the interrupt service model used in the S/UNI-DUPLEX driver design.

Figure 5: Interrupt Service Model



Note: Instead of using an interrupt service model, you can use a polling service model in the S/UNI-DUPLEX driver to process the device's event-indication registers (see page 26).

Calling duplexISR

An interrupt handler function, which is system dependent, must call `duplexISR`. But first, the low-level interrupt-handler function must trap the device interrupts. You must implement this function for your system. As a reference, an example implementation of the interrupt handler (`sysDuplexIntHandler`) appears on page 94. You can customize this example implementation to suit your needs.

The interrupt handler that you implement (`sysDuplexIntHandler`) is installed in the interrupt vector table of the system processor. Then it is called when one or more S/UNI-DUPLEX devices interrupt the processor. The interrupt handler then calls `duplexISR` for each device in the active state.

`The duplexISR` function reads from the master interrupt-status register and the miscellaneous interrupt-status register of the S/UNI-DUPLEX. Then `duplexISR` returns with this status information if a valid status bit is set. If a valid status bit is set, the `duplexISR` also disables that device's interrupts. The `sysDuplexIntHandler` function then sends a message to the DPR task that consists of the device handles of all the S/UNI-DUPLEX devices that had valid interrupt conditions.

Note: Normally you should save the status information for deferred interrupt processing by implementing a message queue. The interrupt handler sends the status information to the queue by the `sysDuplexIntHandler`.

Calling duplexDPR

The `sysDuplexDPRTask` function is a system specific function that runs as a separate task within the RTOS. You should set the DPR task's priority higher than the application task(s) interacting with the S/UNI-DUPLEX driver. In the message-queue implementation model, this task has an associated message queue. The task waits for messages from the ISR on this message queue. When a message arrives, `sysDuplexDPRTask` calls the DPR (`duplexDPR`).

Then `duplexDPR` processes the status information and takes appropriate action based on the specific interrupt condition detected. The nature of this processing can differ from system to system. Therefore, `duplexDPR` calls different indication callbacks for different interrupt conditions.

Typically, you should implement these callback functions as simple message posting functions that post messages to an application task. However, you can implement the indication callback to perform processing within the DPR task context and return without sending any messages. In this case, ensure that the indication function does not call any API functions that change the driver's state, such as `duplexDelete`. Also, ensure that the indication function is non-blocking because the DPR task executes while S/UNI-DUPLEX interrupts are disabled. You can customize these callbacks to suit your system. See page 80 for a description of the callback functions.

Note: Since the `duplexISR` and `duplexDPR` routines themselves do not specify a communication mechanism, you have full flexibility in choosing a communication mechanism between the two. A convenient way to implement this communication mechanism is to use a message queue, which is a service that most RTOSs provide.

You must implement the two system specific functions, `sysDuplexIntHandler` and `sysDuplexDPRTask`. When the driver calls `sysDuplexIntInstallHandler` for the first time, the driver installs `sysDuplexIntHandler` in the interrupt vector table of the processor. The `sysDuplexDPRTask` function is also spawned as a task during this first time invocation of `sysDuplexIntInstallHandler`. The `sysDuplexIntInstallHandler` function also creates the communication channel between `sysDuplexIntHandler` and `sysDuplexDPRTask`. This communication channel is most commonly a message queue associated with the `sysDuplexDPRTask`.

Similarly, during removal of interrupts, the driver removes `sysDuplexIntHandler` from the microprocessor's interrupt vector table and deletes the task associated with `sysDuplexDPRTask`.

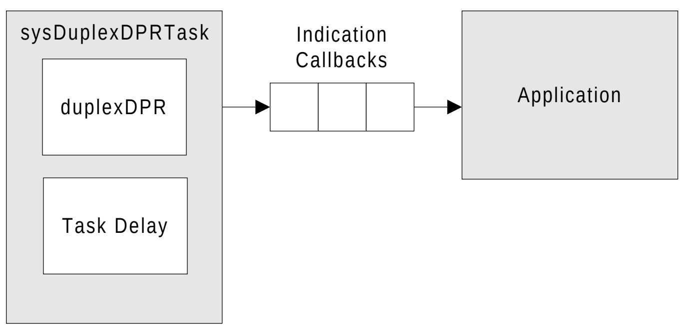
As a reference, this manual provides example implementations of the interrupt installation and removal functions. For more information about the interrupt installation function and prototype, see page 93. For more information about the interrupt removal function and prototype, see page 94. You can customize these prototypes to suit your specific needs.

2.3.4 Polling Servicing

Instead of using an interrupt service model, you can use a polling service model in the S/UNI-DUPLEX driver to process the device's event-indication registers.

Figure 6 illustrates the polling service model used in the S/UNI-DUPLEX driver design.

Figure 6: Polling Service Model



The polling service code includes some system specific code (prefixed by "`sysDuplex`"), which typically you must implement for your application. The polling service code also includes some system independent code (prefixed by "`duplex`") provided by the driver that does not change from system to system.

In polling mode, `sysDuplexIntHandler` and `duplexISR` are not used. Instead, the driver spawns a `sysDuplexDPRTask` function as a task processor when the driver calls `sysDuplexIntInstallHandler` for the first time.

In `sysDuplexDPRTask`, the driver-supplied DPR (`duplexDPR`) is periodically called for each device in the active state. The `duplexDPR` reads from the master interrupt-status and miscellaneous interrupt-status registers of the S/UNI-DUPLEX. If some valid status bits are set, it processes the status information and takes appropriate action based on the specific interrupt condition detected.

The nature of this processing can differ from system to system. Therefore, the DPR calls different indication callbacks for different interrupt conditions. You can customize these callbacks to fit your application's specific requirements. See page 80 for a description of these callback functions.

Similarly, during removal of polling service, the driver removes the task associated with `sysDuplexDPRTask` if none of S/UNI-DUPLEX devices is activated.

3 DRIVER DATA STRUCTURES

The S/UNI-DUPLEX driver uses several data structures. These structures help to:

- Control and store cell header information
- Configure the S/UNI-DUPLEX device
- Identify the device's context
- Support interrupt processing
- Store indication callbacks

3.1 Cell Data Structures

This section describes the data structures that the driver uses to help control cell insertion and extraction. These structures serve as templates for received and transmitted cells.

3.1.1 Cell-Header Data Structure

The following structure stores cell header data.

Table 3: Cell Header Structure: sDPX_CELL_HDR

Member Name	Type	Description
`u1UsrPrpnd[2]`	`UINT1`	Two prepend bytes that you specify
`u1Hdr[5]`	`UINT1`	H1-H5 cell header bytes
`u1UDF`	`UINT1`	A field you define

3.1.2 Cell-Control Data Structure

The following structure controls cell insertion and extraction operations.

Table 4: Cell Control Structure: sDPX_CELL_CTRL

Member Name	Type	Description
`u4Crc32Prev`	`UINT4`	The CRC-32 value in the insert and extract CRC-32 accumulator registers after the previous cell was inserted or extracted. Used to preset the accumulator registers before inserting or extracting the next cell.
`u4Crc32`	`UINT4`	The CRC-32 value in the insert and extract accumulator registers after the current cell was inserted or extracted.

`u1CellType`	`UINT1`	A flag used by the driver to indicate that the cell extracted is the last cell or first cell of a message, and is CRC protected or not.
		• Bit 0:
		  • If 1, then CRC-32 on
		  • If 0, then CRC-32 off
		• Bit 1:
		  • If 1, then first cell
		  • If 0, then not first cell
		• Bit 2:
		  • If 1, then last cell
		  • If 0, then not last cell

3.2 Device-Configuration Data Structures

This section describes the data structures that the driver uses to initialize and configure the S/UNI-DUPLEX device.

3.2.1 Initialization Data Structure

The device initialization function initializes the S/UNI-DUPLEX device and its associated context structures. This involves reading an initialization vector. The driver validates this vector and then configures the S/UNI-DUPLEX device accordingly.

The application sets the initialization vector before initializing a S/UNI-DUPLEX device. The initialization vector contains configuration parameters that the driver uses to program the S/UNI-DUPLEX device control-registers.

Note: The application must free the initialization vector memory.

Table 5: Initialization Vector: sDPX_INIT_VECTOR

Member Name	Type	Description
sRegInfo	sDPX_REGS	Contains the values that the driver will write to the control registers of the S/UNI-DUPLEX device
indNotify	DPX_IND_CB_FN	Indication callback function called by the DPR when a significant event occurs in the driver software
indRxBOC	DPX_IND_CB_FN	Indication callback function called by the DPR to forward a received valid BOC to the application
indRxCell	DPX_IND_CB_FN	Indication callback function called by the DPR when the driver must read cells from the Extract FIFOs
pCellTypeFn	DPX_CELLTYPE_FN	A Cell Type detector function that is used by the driver to determine if a cell extracted is the last or first of a particular message, and/or if it is CRC-32 protected
u4Reserved	UINT4	Placeholder for future use

3.2.2 Register Data Structure

The register data structure contains the initial values that the driver will write to the S/UNI-DUPLEX device control-registers.

Table 6: Device Registers: sDPX_REGS

Member Name	Type	Description
u1MasterCfg	UINT1	Master configuration register

Member Name	Type	Description
sSciAnyPhyRegs	sDPX_SCI_ANY_PHY_REGS	SCI-PHY/Any-PHY configuration registers
sHssRegs	sDPX_HSS_REGS	HSS-link configuration registers
sClkSerRegs	sDPX_CLK_SER_REGS	Clocked-bit serial-interface configuration registers
sIntEnRegs	sDPX_INT_ENBLS	Interrupt enable registers

Table 7: SCI-PHY/Any-PHY Registers: sDPX_SCI_ANY_PHY_REGS

Member Name	Type	Description
u1ExtAddrMatch[2]	UINT1	Extended address match [2 bytes (LSB, MSB)]
u1ExtAddrMask[2]	UINT1	Extended address mask [2 bytes (LSB, MSB)]
u1OutAddrMatch	UINT1	Output address match register
u1SciAnyPhyInpCfg[2]	UINT1	SCI-PHY/Any-PHY input configuration (2 bytes)
u1ICAEnable[4]	UINT1	Input cell available enable (4 bytes)
u1SciAnyPhyOutCfg	UINT1	SCI-PHY/Any-PHY output configuration
u1SciAnyPhyOutPollRng	UINT1	SCI-PHY/Any-PHY output polling range

Table 8: HSS Link Registers: sDPX_HSS_REGS

Member Name	Type	Description
u1RxCfg[2]	UINT1	Receive HSS configuration [2 bytes (RXD1, RXD2)]

Member Name	Type	Description
`u1RxCfg[2]`	`UINT1`	Receive HSS configuration [2 bytes (RXD1, RXD2)]
`u1RxHcsPass[2]`	`UINT1`	Receive HSS cell-filtering configuration (HCSPASS) [2 bytes (RXD1, RXD2)]
`u1TxCfg`	`UINT1`	Transmit HSS configuration

Table 9: Clocked Serial-Interface Registers: sDPX_CLK_SER_REGS

Member Name	Type	Description
`u1RxCfg[16]`	`UINT1`	Receive serial indirect-channel configuration
`u1RxLcdCntThresh[16]`	`UINT1`	Receive serial LCD-count threshold
`u1TxSerIndChnlData[16]`	`UINT1`	Transmit serial indirect-channel data register
`u1TxFrameBitThresh`	`UINT1`	Transmit serial framing-bit threshold

3.3 Device-Context Data Structures

This section describes the data structures that the driver uses to store data about the S/UNI-DUPLEX device and related devices.

3.3.1 Global Driver-Database Structure

The Global Driver Database (GDD) stores module level data, such as the number of devices that the driver controls and an array of pointers to the individual device context structures (DDBs).

Table 10: Global Driver Database: sDPX_GDD

Member Name	Type	Description
u1NumDevs	UINT1	Number of devices added
pDdb[DPX_MAX_NUM_DEVS]	sDPX_DDB*	Array of pointers to the individual DDBs
u4Reserved	UINT4	Reserved for future use

3.3.2 Device Data-Block Structure

The DDB contains device context data, such as:

- Device state
- Control data
- Initialization vector
- Callback function pointers

The driver allocates the DDB memory when the driver registers a new device. The memory is deallocated when an existing device is deleted.

Table 11: Device Data Block: sDPX_DDB

Member Name	Type	Description
usrCtxt	DPX_USR_CTXT	This variable stores the device's role in the context of your system. The driver passes it as an input parameter when the driver calls an application callback.
pSysInfo	VOID *	Pointer to system-specific device information. For example, in PCI bus environments, the bus, device, function numbers, IRQ assignment etc.

Member Name	Type	Description
u4BaseAddr	UINT4	Base address of the device
eDevMode	eDPX_MODE	Device mode, which can be one of: • DPX_SCI_MASTER • DPX_SCI_ANY_SLAVE • DPX_CLK_BIT_SER
eDevState	eDPX_STATE	Device state, which can be one of the following enumerated type values: • DPX_EMPTY • DPX_PRESENT • DPX_INIT • DPX_ACTIVE
u1IntrProcEn	UINT1	1: Interrupt processing enabled 0: Interrupt processing disabled
sInitVector	sDPX_INIT_VECTOR	Device configuration information passed by the application to the driver. The driver writes the appropriate S/UNI-DUPLEX device registers based on the contents of this vector.
sIntEnbls	sDPX_INT_ENBLS	Maintains a snapshot of the current interrupt-enables registers for the S/UNI-DUPLEX device
indNotify	DPX_IND_CB_FN	Indication callback function called by the DPR when a significant event occurs in the driver software

Member Name	Type	Description
indRxBOC	DPX_IND_CB_FN	Indication callback function called by the DPR to forward a received valid BOC to the application
indRxCell	DPX_IND_CB_FN	Indication callback function called by the DPR when the driver must read cells from the Extract FIFOs
pCellTypeFn	DPX_CELLTYPE_FN	A cell-type detector function that the driver uses to determine if a cell extracted is the last or first cell of a the message, and if it is CRC protected
sStatCounts	sDPX_STAT_COUNTS	Contains the statistical counts for events and the number of interrupts
lockId	DPX_SEM_ID	Semaphore ID for the data structure. It is used for mutual exclusion access to the structure.
u4Reserved	UINT4	Placeholder for future use

3.4 Interrupt Data Structures

This section describes the data structures that the S/UNI-DUPLEX driver uses to queue interrupt context data for interrupt-enable bit-setting data.

3.4.1 Interrupt-Enable Data Structure

The interrupt-enable bit-setting data is queued in the following structure.

Table 12: Interrupt Enables: sDPX_INT_ENBLS

Member Name	Type	Description
u1MasterEn	UINT1	Master Interrupt Enable
u1RoolEn	UINT1	ROOLE bit (tracks change in ROOLV bit; located in clock monitor register)
u1SciAnyPhyInpIntEn	UINT1	SCI-PHY/Any-PHY Input Interrupt Enables
u1SciAnyPhyOutIntEn	UINT1	SCI-PHY/Any-PHY Output Interrupt Enable (CELLXFERRE bit)
u1MicroCellBufCtrl	UINT1	Microprocessor Cell Buffer Interrupt Control
u1RxLogChnlFifoCtrl	UINT1	Receive Logical Channel FIFO Control (FOVRE bit)
u1RxHssExtractFifoOvr[2]	UINT1	RXD1 and RXD2 Extract FIFO Control (UPF1OVRE bit)
u1RxHssIntEn[2]	UINT1	Receive HSS Interrupt Enables [2 bytes (RXD1, RXD2)]
u1RxHssBocIntEn[2]	UINT1	Receive HSS BOC Interrupt Enables [2 bytes (RXD1, RXD2)]
u1TxLogChnlFifoCtrl	UINT1	Transmit Logical Channel FIFO Control (FOVRE bit)
u1RxClkSerIntEn[16]	UINT1	Receive Serial Indirect Channel Interrupt Enables

3.4.2 Interrupt-Context Data Structure

The following structure passes interrupt context data from the interrupt servicing routine to the DPR.

Table 13: Interrupt Context: sDPX_INT_CTXT

Member Name	Type	Description
u1NumDevs	UINT1	Number of devices for which interrupts have to be processed
pu4DevHandles [DPX_MAX_NUM_DEVS]	UINT4*	Array of size DPX_MAX_NUM_DEVS. The first u1NumDevs elements of this array contain the device handles for the devices for which interrupts have to be processed.

3.5 Count Structures

This section describes the data structures that the S/UNI-DUPLEX driver uses to store counts.

3.5.1 HSS Counts

This section describes the data structure that the driver uses to store the number of HSS cells received and transmitted, and the number of cells that failed to be received.

Table 14: HSS Counts: sDPX_HSS_CNTS

Member Name	Type	Description
u4RxCells[2]	UINT4	Cells received count [2 words (RXD1, RXD2)]
u4TxCells	UINT4	Cells transmitted count
u1HcsErrs[2]	UINT1	HCS received count [2 bytes (RXD1, RXD2)]

3.5.2 Statistical Counts

This section describes the data structure that the driver uses to store statistical counts.

Table 15: Statistical Counts: sDPX_STAT_COUNTS

Member Name	Type	Description
`Count_Tx_Hss_Count_Overflow`	UINT4	Corresponds to register 0x61, bit 5
`Count_Tx_Hss_Count_Updated`	UINT4	Corresponds to register 0x61, bit 6
`Count_Rx_Lc_Fifo_Overflow`	UINT4	Corresponds to register 0x3D, bit 0
`Count_Tx_Lc_Fifo_Overflow`	UINT4	Corresponds to register 0x5D, bit 0
`Count_Phy_Input_Cell_Xfered`	UINT4	Corresponds to register 0x0F, bit 2
`Count_Invalid_SOC_Sequence`	UINT4	Corresponds to register 0x0F, bit 1
`Count_Phy_Input_Parity`	UINT4	Corresponds to register 0x0F, bit 0
`Count_Phy_Output_Error`	UINT4	Corresponds to register 0x14, bit 7
`Count_Micro_Insert_Fifo_Ready`	UINT4	Corresponds to register 0x20, bit 4
`Count_Micro_Insert_Fifo_Full`	UINT4	Corresponds to register 0x20, bit 5
`Count_Extract_Cell_CRC_Error`	UINT4	Corresponds to register 0x20, bit 7
`Count_Clock_Lock_Fail`	UINT4	Corresponds to register 0x04, bit 3
`Count_RxSerChnl_Out_Of_Delin [16]`	UINT4	Corresponds to register 0x6B, bits 0,6
`Count_RxSerChnl_In_Delin[16]`	UINT4	Corresponds to register 0x6B, bits 0,6

Member Name	Type	Description
Count_RxSerChnl_Fifo_Overflow [16]	UINT4	Corresponds to register 0x6B, bit 1
Count_RxSerChnl_HCS_Error[16]	UINT4	Corresponds to register 0x6B, bit 2
Count_RxSerChnl_Out_Of_Sync [16]	UINT4	Corresponds to register 0x6B, bits 3,7
Count_RxSerChnl_in_Sync[16]	UINT4	Corresponds to register 0x6B, bits 3,7
Count_RxHss_Extract_Fifo_ Overflow[2]	UINT4	Corresponds to registers 0x31, 0x35, bit 0
Count_RxHss_Loss_Of_Signal[2]	UINT4	Corresponds to registers: • 0x43, 0x53, bit 0 • 0x41, 0x51, bit 0
Count_RxHss_Signal_Detected [2]	UINT4	Corresponds to registers: • 0x43, 0x53, bit 0 • 0x41, 0x51, bit 0
Count_RxHss_Out_Of_Delin[2]	UINT4	Corresponds to registers: • 0x43, 0x53, bit 1 • 0x41, 0x51, bit 1
Count_RxHss_In_Delin[2]	UINT4	Corresponds to registers: • 0x43, 0x53, bit 1 • 0x41, 0x51, bit 1
Count_RxHss_Active_Bit[2]	UINT4	Corresponds to registers: • 0x43, 0x53, bit 2 • 0x41, 0x51, bit 2
Count_RxHss_No_Active_Bit[2]	UINT4	Corresponds to registers: • 0x43, 0x53, bit 2 • 0x41, 0x51, bit 2

Member Name	Type	Description
`Count_RxHss_Out_Of_Sync[2]`	`UINT4`	Corresponds to registers: • 0x43, 0x53, bit 4 • 0x41, 0x51, bit 4
`Count_RxHss_In_Sync[2]`	`UINT4`	Corresponds to registers: • 0x43, 0x53, bit 4 • 0x41, 0x51, bit 4
`Count_RxHss_CRC8_Error[2]`	`UINT4`	Corresponds to registers 0x43, 0x53, bit 3
`Count_RxHss_HCS_Error[2]`	`UINT4`	Corresponds to registers 0x43, 0x53, bit 5
`Count_RxHss_Count_Updated[2]`	`UINT4`	Corresponds to registers 0x43, 0x53, bit 6
`Count_RxHss_Count_Overflow[2]`	`UINT4`	Corresponds to registers 0x43, 0x53, bit 7
`Count_Rx_BOCs[2]`	`UINT4`	Corresponds to registers 0x19, 0x1B, bit 6
`Count_Extract_Cells`	`UINT4`	Corresponds to register 0x20, bit 6
`Count_Interrupts`	`UINT4`	Number of interrupts occurred for the device

4 APPLICATION INTERFACE FUNCTIONS

The driver's API is a collection of high level functions that application programmers can call to configure, control, and monitor S/UNI-DUPLEX devices.

Note: These functions are not re-entrant. This means that two application tasks cannot invoke the same API at the same time. However, the driver protects it’s data structures from concurrent accesses by the application and the DPR task.

The application interface also consists of callback functions. These callback functions notify the application of significant events that take place within the device and driver, such as:

- Occurrence of critical errors
- Reception of cells
- Reception of valid BOCs

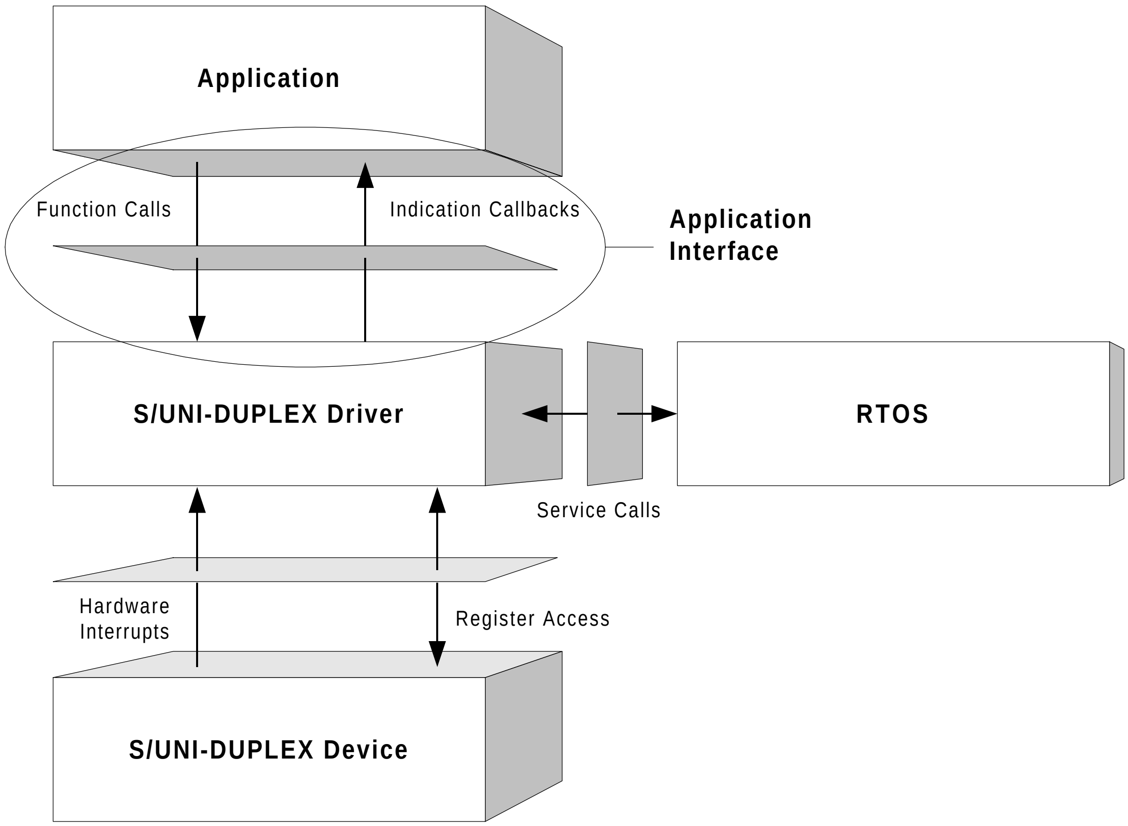
The duplexDPR routine invokes the indication callback functions. These execute in the context of the DPR task. Typically, these callback routines are implemented as simple message posting routines that post messages to an application task. However, the user can choose to implement the indication callback to perform processing within the DPR task context and return without sending any messages. In this case, ensure that the indication routine does not call any API function that changes the driver’s state, such as duplexDelete.

The indication routine should be non-blocking because the DPR task executes while interrupts are disabled. The DPR task is also responsible for re-enabling device interrupts once the deferred processing is complete.

Many API functions change the device’s state. For information about device states, see page 19.

Figure 7 illustrates the external interfaces defined for the S/UNI-DUPLEX driver.

Figure 7: Application Interface



4.1 Driver Initialization and Shutdown

This section describes the API functions used to initialize and shutdown the driver's modules.

4.1.1 duplexModuleInit: Initializing Driver Modules

This function performs module level initialization of the device driver. This involves allocating memory for the GDD and initializing the data structure.

Valid States Not applicable

Side Effects None

Prototype `INT4 duplexModuleInit(VOID)`

Inputs	None
Outputs	None
Return Codes	`DPX_SUCCESS`
	`DPX_ERR_MEM_ALLOC` (memory allocation failure)
	`DPX_ERR_MODULE_ALREADY_INIT`

4.1.2 duplexModuleShutdown: Shutting Down Driver Modules

This function performs module level shutdown of the driver. This involves deleting all devices controlled by the driver and deallocating the GDD.

Valid States	All states
Side Effects	Resets all the devices, and removes interrupt handle and DPR task
Prototype	`VOID duplexModuleShutdown(VOID)`
Inputs	None
Outputs	None
Return Codes	None

4.2 Device Addition, Reset, and Deletion

When you add a new S/UNI-DUPLEX device, the driver's device-addition functions allocate memory to store context information for new devices. The driver also applies a software reset to the device. The device deletion function deallocates device context memory during device shutdown.

4.2.1 duplexAdd: Adding Devices

This function detects the new device in the hardware, gets the base address of the device, and allocates memory for the DDB. Then it stores the device's role (within your system's context) and returns the pointer to the DDB as a handle back to your system. You should use the device handle to identify the device on which the driver will perform the operation.

This function also reads the configuration pins status register to determine the configuration of the SCI-PHY/Any-PHY and clocked serial-data interfaces. The driver uses this information to set the device mode in the DDB.

Valid States `DPX_EMPTY`

Side Effects This function puts the device in the DPX_PRESENT state. The function applies a software reset to the device.

Prototype `INT4 duplexAdd(DPX_USR_CTXT usrCtxt, DUPLEX *pDuplex)`

Inputs `usrCtxt`: Pointer to context information (maintained by your system) for the device being added

Outputs `pDuplex`: Pointer to the S/UNI-DUPLEX device handle. The variable type, DUPLEX, is actually the following type, which you define:

- `#define DUPLEX (void *)`

This prevents the application from accessing the DDB directly.

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_DEV_NOT_DETECTED` (device was not detected)

`DPX_ERR_MEM_ALLOC` (memory allocation failure)

`DPX_ERR_DEV_ID_TYPE` (invalid device ID and/or type)

4.2.2 duplexReset: Resetting Devices

This function applies a software reset to the S/UNI-DUPLEX device. It also resets all of the device's context information in the DDB (except for the initialization vector, which it leaves unmodified). Typically, the driver calls this function during device shutdown, or before re-initializing the device with an initialization vector.

Valid States All states except `DPX_EMPTY`

Side Effects This function puts the device in the `DPX_PRESENT` state. Therefore, the driver must initialize the device after a reset.

Prototype `INT4 duplexReset(DUPLEX duplex)`

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

4.2.3 duplexRemoteReset: Resetting Other Devices

This function resets other devices by driving the RSTOB output pin of the S/UNI-DUPLEX device low and then back to a high impedance state. It does this by setting and resetting the RESET0 pin in the master configuration register.

Valid States All states except `DPX_EMPTY`

Side Effects None

Prototype `INT4 duplexRemoteReset(DUPLEX duplex)`

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

4.2.4 duplexDelete: Deleting Devices

This function removes the specified device from the list of devices controlled by the S/UNI-DUPLEX driver. Deleting a device involves deallocating the DDB for that device.

Valid States `DPX_PRESENT`

Side Effects This function changes the device state to `DPX_EMPTY`

Prototype	`INT4 duplexDelete(DUPLEX duplex)`
Inputs	`duplex`: Device handle used by the driver to access context information for the device (DDB)
Outputs	None
Return Codes	`DPX_SUCCESS`
	`DPX_ERR_INVALID_DEVICE` (invalid device handle)
	`DPX_ERR_INVALID_STATE` (invalid device state)

4.3 Reading from and Writing to Devices

This section describes the API functions used to read from and write to S/UNI-DUPLEX devices. Their tasks include reading from and writing to the registers of a device.

4.3.1 duplexRead: Reading from Device Registers

This function can read from a register of a specific S/UNI-DUPLEX device by providing the register identifier. This function derives the actual address location based on the device handle and register identifier inputs. It then reads the contents of this address location using the system specific macro, `sysDuplexRawRead`.

Prototype	`INT4 duplexRead(DUPLEX duplex, UINT2 u2RegId, UINT1 *pu1Val)`
Inputs	`duplex`: Pointer to device context information
	`u2RegId`: Register identifier
Outputs	`pu1Val`: Register value
Return Codes	`DPX_SUCCESS`
	`DPX_ERR_INVALID_DEVICE` (invalid device handle)
	`DPX_ERR_EXCEED_REG_RANGE` (`u2RegId` exceeds the register range)

4.3.2 duplexWrite: Writing to Device Registers

This function can write to a register of a specific S/UNI-DUPLEX device by providing the register identifier. This function derives the actual address location based on the device handle and register identifier inputs. It then writes the contents of this address location using the system specific macro, `sysDuplexRawWrite`.

Prototype `INT4 duplexWrite(DUPLEX duplex, UINT2 u2RegId, UINT1 u1Val)`

Inputs `duplex`: Pointer to device context information

`u2RegId`: Register identifier

`u1Val`: Value to be written

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_EXCEED_REG_RANGE` (`u2RegId` exceeds the register range)

4.4 Device Initialization

This section describes the API functions used to initialize S/UNI-DUPLEX devices. Their tasks include initializing the device based on the initialization vector passed by the application. They also install and remove the indication callback functions that `duplexDPR` calls.

4.4.1 duplexInit: Initializing Devices

This function initializes the device based on the initialization vector passed by the application. The driver validates this initialization vector and then stores it in the device's DDB. The driver then configures the device registers accordingly.

Valid States `DPX_PRESENT`

Side Effects This function puts the device in the `DPX_INIT` state

Prototype `INT4 duplexInit(DUPLEX duplex, sDPX_INIT_VECT, sInitVector)`

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

`sInitVector`: Initialization vector that the driver uses to program the device registers

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_INVALID_INIT_VECTOR` (invalid initialization vector)

`DPX_ERR_INDIRECT_CHANNEL_BUSY` (Clocked serial channel is busy and causes timeout when its registers are accessed)

4.4.2 duplexInstallIndFn: Installing Indication Callback Functions

This function installs the indication callback functions (which you define) that `duplexDPR` calls. The function pointer is stored in the device context structure (the DDB).

Valid States `DPX_INIT`

Side Effects None

Prototype `INT4 duplexInstallIndFn(DUPLEX duplex, eDPX_CB_TYPE eCbType, DPX_IND_CB_FN pCbFn)`

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

`eCbType`: Identifies the callback being installed, which can be one of:

- `DPX_CB_NOTIFY`
- `DPX_CB_RX_BOC`
- `DPX_CB_RX_CELL`

`pCbFn`: Callback function that the driver is installing

Outputs

None

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_CB_TYPE` (invalid callback function type)

4.4.3 duplexRemoveIndFn: Removing Indication Callback Functions

This function removes the indication callback functions (which you define) that `duplexDPR` calls.

Valid States

`DPX_INIT`

Side Effects

The driver will no longer report events to the application.

Prototype

```
INT4 duplexRemoveIndFn(DUPLEX duplex,
eDPX_CB_TYPE eCbType)
```

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

`eCbType`: Identifies the callback being installed, which can be one of:

- `DPX_CB_NOTIFY`
- `DPX_CB_RX_BOC`
- `DPX_CB_RX_CELL`

Outputs

None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_CB_TYPE` (invalid callback function type)

4.5 Device Activation and Deactivation

This section describes the API functions used to activate and deactivate S/UNI-DUPLEX devices. These functions set the device interrupts and other global enables.

4.5.1 duplexActivate: Activating Devices

This function activates the S/UNI-DUPLEX device by preparing it for normal operation. This involves enabling device interrupts and other global enables (for example, the HSS link transmitter).

Valid States `DPX_INIT`

Side Effects Puts the device in `DPX_ACTIVE` state.

Prototype `INT4 duplexActivate(DUPLEX duplex)`

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

4.5.2 duplexDeactivate: Deactivating Devices

This function de-activates the S/UNI-DUPLEX device and removes it from normal operation. This involves disabling device interrupts and other global disables (for example, the HSS link transmitter).

Valid States `DPX_ACTIVE`

Side Effects Puts the device in `DPX_INIT` state.

Prototype `INT4 duplexDeactivate(DUPLEX duplex)`

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

4.6 Device Diagnostics

This section describes the API functions used to diagnose the S/UNI-DUPLEX device. Their tasks include:

- Verifying the correctness of the microprocessor's access to the device registers
- Enabling or disabling a diagnostic or line loopback on the HSS interfaces
- Monitoring the activity of the device's clocks

4.6.1 duplexRegisterTest: Verifying Device Register Access

This function verifies the correctness of the microprocessor's access to the device registers by writing values to the writable registers and reading them back.

Valid States `DPX_PRESENT`

Side Effects Puts the device in the `DPX_PRESENT` state after the test. Therefore, the device should be re-initialized after calling this function.

Prototype `INT4 duplexRegisterTest(DUPLEX duplex)`

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_FAILURE` (test failed)

4.6.2 duplexLoopback: Enabling/Disabling Diagnostic or Line Loopback

This function enables or disables a diagnostic or line loopback on the HSS interfaces.

Valid States All states except `DPX_EMPTY`

Side Effects None

Prototype

```
INT4 duplexLoopback(DUPLEX duplex, UINT1
u1HssLnkId, UINT1 u1LpbkType, UINT1 u1Enable)
```

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

`u1HssLnkId`: HSS link identifier. Valid identifiers are `DPX_RXD1` and `DPX_RXD2`.

`u1LpbkType`: Type of loopback. It can be `DPX_DIAG_LPBK` or `DPX_LINE_LPBK`.

`u1Enable`: Loopback operation requested. It can be `DPX_LPBK_SET` or `DPX_LPBK_RESET`.

Outputs None

Return Codes DPX_SUCCESS

DPX_ERR_INVALID_DEVICE (invalid device handle)

DPX_ERR_INVALID_STATE (invalid device state)

DPX_ERR_INVALID_LPBK_TYPE (invalid loopback type)

DPX_ERR_INVALID_HSS_ID (invalid HSS-link identifier)

DPX_ERR_INVALID_FLAG (invalid loopback flag)

4.6.3 duplexGetClockStatus: Monitoring Device Clocks

This function monitors the activity of the S/UNI-DUPLEX device clocks. It reads the contents of the clock monitor register and provides the status of each clock in a bit vector format. The application should call this function periodically to check if the clock signals are making low to high transitions.

Valid States All states except DPX_EMPTY

Side Effects None

Prototype INT4 duplexGetClockStatus(DUPLEX duplex, UINT1 *pu1ClkStat)

Inputs duplex: Pointer to DDB that contains device context information maintained by the driver

Outputs pu1ClkStat: Contains the following bit vector that indicates the active/inactive status of the S/UNI-DUPLEX device clocks. A one in the bit position indicates that the clock is active. A zero indicates that the clock is inactive.

- Bit 0: Input FIFO clock (IFCLK) (SCI-PHY/Any-PHY Interface)
- Bit 1: Output FIFO clock (OFCLK) (SCI-PHY/Any-PHY Interface)
- Bit 2: Reference clock input (REFCLK)

Return Codes DPX_SUCCESS

DPX_ERR_INVALID_DEVICE (invalid device handle)

4.7 HSS Link Configuration

This section describes the API functions used to configure HSS links. Their tasks include:

- Retrieving the contents of the specified HSS-link's configuration registers
- Configuring or modifying the contents of the specified HSS-link's configuration registers
- Getting a snapshot of the state of the eight HSS links for the specified device
- Retrieving the logical-channel address information for all HSS links of the specified device

4.7.1 duplexHssActiveLnkGetCfg: Getting HSS-Link Selection Method Information

This function obtains information about the active-link selection method configured in the Master Configuration register. This information states whether the active link is set automatically by the S/UNI-DUPLEX, or if it was set manually by the application. If the active link was set manually, then this information states what the manual setting is.

Valid States `DPX_INIT, DPX_ACTIVE`

Side Effects None

Prototype `INT4 duplexHssActiveLnkGetCfg(DUPLEX duplex, eHSS_LNK_SEL *peLnkSel)`

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

Outputs `peLnkSel`: Specifies the HSS link selection. It can be one of:

- `DPX_RX_HSS_LNK_SELECT_AUTO`
- `DPX_RX_HSS_LNK_SELECT_RXD1`
- `DPX_RX_HSS_LNK_SELECT_RXD2`

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

4.7.2 duplexHssActiveLnkSetCfg: Setting Active HSS Links

This function sets the active HSS link of the S/UNI-DUPLEX device. The active link can be set automatically by the device or set manually by the application.

Valid States `DPX_INIT, DPX_ACTIVE`

Side Effects None

Prototype `INT4 duplexHssActiveLnkSetCfg(DUPLEX duplex, eHSS_LNK_SEL eLnkSel)`

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

`eLnkSel`: Specifies the HSS link selection, which can be one of:

- `DPX_RX_HSS_LNK_SELECT_AUTO`
- `DPX_RX_HSS_LNK_SELECT_RXD1`
- `DPX_RX_HSS_LNK_SELECT_RXD2`

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

4.7.3 duplexHssGetConfig: Getting HSS-Link Configuration Information

This function retrieves the contents of the specified HSS link's configuration registers. With one call, this function can retrieve the value of individual configuration registers as well as the entire configuration register set.

Valid States `DPX_INIT, DPX_ACTIVE`

Side Effects None

Prototype `INT4 duplexHssGetConfig(DUPLEX duplex, eDPX_HSS_REG eHssRegId, sDPX_HSS_REGS *psHssRegs)`

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

`eHssRegId`: Specifies the register holding the value the driver will retrieve. It can be one of:

- `DPX_RX_HSS_CFG_RXD0`
- `DPX_RX_HSS_CFG_RXD1`
- `DPX_RX_HSS_CELL_FILTER_CFG_RXD0`
- `DPX_RX_HSS_CELL_FILTER_CFG_RXD1`
- `DPX_TX_HSS_CFG`
- `DPX_ALL_HSS_REGS`

Note: The logical-channel base address and address range are retrieved together. In addition, the driver can retrieve all configuration registers at once using `DPX_ALL_HSS_REGS`.

Outputs

`psHssRegs`: Contents of the specified HSS-link control register(s) output by this function. These contents are valid only if the function returns `DPX_SUCCESS`. Further, only those fields of this structure are valid that have been requested using the input parameter, `eHssRegId`.

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_INVALID_REG_ID` (invalid register ID)

4.7.4 duplexHssSetConfig: Modifying HSS-Link Configuration Information

This function sets up or modifies the contents of the specified HSS-link's configuration registers. With one call, this function can set the value of individual configuration registers as well as the entire configuration register set.

Valid States `DPX_INIT, DPX_ACTIVE`

Side Effects None

Prototype `INT4 duplexHssSetConfig(DUPLEX duplex, eDPX_HSS_REG eHssRegId, sDPX_HSS_REGS *psHssRegs)`

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

`eHssRegId`: Specifies the register with the value the driver will write. It can be one of:

- `DPX_RX_HSS_CFG_RXD0`
- `DPX_RX_HSS_CFG_RXD1`
- `DPX_RX_HSS_CELL_FILTER_CFG_RXD0`
- `DPX_RX_HSS_CELL_FILTER_CFG_RXD1`
- `DPX_TX_HSS_CFG`
- `DPX_ALL_HSS_REGS`

Note: The logical channel base address and address range have to be set together. In addition, the driver can set all configuration registers at once using `DPX_ALL_HSS_REGS`.

`psHssRegs`: Contents of the specified HSS-link control register(s) to be set. The only fields in this structure that will be set are those that the driver has requested using `eHssRegId`.

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_INVALID_REG_ID` (invalid register ID)

4.8 HSS-Link Cell Insertion and Extraction

This section describes the API functions used to insert cells into, and extract cells from, HSS-links. Their tasks include:

- Transmitting a cell on a specified HSS-link ’s control channel
- Extracting a cell received on a specified HSS-link ’s control channel

- Returning the contents of the microprocessor extract FIFO ready register
- Enabling the interrupt indication for a cell's reception
- Installing a callback function that determines the type of cell being extracted

4.8.1 duplexInsertCell: Inserting Cells into HSS Links

This function transmits a cell on the control channel of both the active and standby HSS links. This function can send messages, which you define, over the HSS links. If the message is longer than the length of a cell's payload, then the application should segment the message into 48 byte cells. Call this function repeatedly until all the cells that constitute the message have been transmitted.

Optionally, a 32-bit CRC can protect messages. The CRC accumulates each time a cell belonging to the message is sent. For the last cell of the message (indicated by the application), the CRC is inserted into the last four bytes of the cell's payload.

Message interleaving (over different circuits in the same control channel) is allowed. For CRC-32 protected messages, message interleaving requires the application to save the intermediate CRC-32 value output by this function, if a cell has to be sent out on another control channel or another circuit on the same control channel.

Valid States `DPX_ACTIVE`

Side Effects You should give cell reception higher priority than cell transmission to prevent extract FIFO overflow. In other words, all cells of a received message should be extracted before switching context.

Prototype

```
INT4 duplexInsertCell(DUPLEX duplex,
sDPX_CELL_HDR *psCellHdr, UINT1 *pu1CellPyld,
sDPX_CELL_CTRL *psCtrl)
```

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

`psCellHdr`: Pointer to the cell header structure that contains the two prepend bytes that you define (optional), H1-H4 bytes, and the H5 (optional) and UDF (optional) bytes. The driver uses the optional bytes based on the TX HSS configuration register contents.

`pu1CellPyld`: Pointer to first byte of cell payload (48 contiguous bytes)

`psCtrl->u1CrcFlg`: Control flag containing the following bit vectors:

- Bit 0: Flag for CRC protection flag
- Bit 1: Flag for first cell of a CRC protected message
- Bit 2: Flag for last cell of a CRC protected message

`psCtrl->u4Crc32Prev`: Used to restore previously saved CRC-32 value output by this function. Only applicable if bit 0 of `psCtrl->u1CrcFlg` is set.

Outputs

`psCtrl->u4Crc32`: Used to output CRC-32 value after writing a cell. The driver then passes this value back as an input parameter (`psCtrl->u4Crc32Prev`) for the next cell to be transmitted on the same control channel connection.

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_CELL_TX_BUSY` (cell transmission port busy)

4.8.2 duplexExtractCell: Extracting Cells from HSS Links

This function extracts a cell received on a specified HSS-link 's control channel. This function also receives messages, which you define, that can span multiple cells. The application must call this function once for each cell that constitutes the message.

If the incoming message contains a CRC-32 field at the end, then the driver can perform a CRC check over the body of the message. The function also provides the header information of the cell to the calling function.

Valid States `DPX_ACTIVE`

Side Effects You should give cell reception a higher priority than cell transmission to prevent extract FIFO overflow. In other words, all cells of a received message should be extracted before switching context.

Prototype

```
INT4 duplexExtractCell(DUPLEX duplex, UINT1
u1HssLnkId, sDPX_CELL_HDR *psCellHdr, UINT1
*pu1CellPyld, sDPX_CELL_CTRL *psCtrl)
```

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

`u1HssLnkId`: HSS link identifier. Valid identifiers are `DPX_RXD1` and `DPX_RXD2`.

Outputs

`psCellHdr`: Pointer to the cell header-data received

`pu1CellPyld`: Pointer to first byte of cell payload 48 contiguous bytes)

`psCtrl->u4Crc32`: Used to output CRC-32 value after reading a cell. The driver then passes this value back as an input parameter (`psCtrl->u4Crc32Prev`) for the next cell to be extracted on the same control channel connection.

`psCtrl->u1CrcFlg`: This is a control flag. Contains the following bit vector:

- Bit 0: CRC protection flag
- Bit 1: Flag for first cell of a CRC protected message
- Bit 2: Flag for last cell of a CRC protected message

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_INVALID_LNK_ID` (invalid link ID)

`DPX_ERR_CB_FN_NOT_INSTALLED` (callback function is not installed yet)

`DPX_ERR_CELL_RX_CRC` (cell reception CRC error)

4.8.3 duplexCheckExtractFifos: Getting Contents of the Extract-FIFO-Ready Register

This function returns the contents of the microprocessor extract-FIFO-ready register. This function can check if there are any cells to extract from the extract FIFOs.

Valid States `DPX_ACTIVE`

Side Effects None

Prototype

```
UINT4 duplexCheckExtractFifos(DUPLEX duplex,
UINT1 *pu1CellReady)
```

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

Outputs `pu1CellReady:` Contains the following bit vector, which represents the state of each extract FIFO:

- Bit 0:
  - If value is 1, then `RXD1` has at least one cell ready for extraction
  - If value is 0, then no cells present
- Bit 1:
  - If value is 1, then `RXD2` has at least one cell ready for extraction
  - If value is 0, then no cells present

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

4.8.4 duplexEnableRxCellInd: Enabling the Received Cell Indicator

This function enables the interrupt indication in the device for the reception of a cell. The application calls this function after it has responded to a previous indication by extracting all received cells (using multiple `duplexExtractCell` calls). The application task can now re-enable this indication and wait for the arrival of more cells.

Valid States `DPX_ACTIVE`

Side Effects None

Prototype `INT4 duplexEnableRxCellInd(DUPLEX duplex)`

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

4.8.5 duplexInstallCellTypeFn: Installing Callback Functions

This function can install a callback function (which you define) that the driver uses to determine the type of cell it is extracting. The detector function takes a cell header as the input argument and returns a cell type byte and the previous CRC-32 value for the same message of the same logical channel.

Valid States `DPX_INIT, DPX_ACTIVE`

Side Effects None

Prototype `duplexInstallCellTypeFn(DUPLEX duplex, DPX_EOM_FN pCellTypeFn)`

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

`pCellTypeFn`: Pointer to the EOM detector function. The prototype of this function is:

- `UINT1 pCellTypeFn(UINT1 *pu1Hdr, UINT4 *pu4Crc32Prev)`

In the detector function, `pu1Hdr` is the pointer to the first byte of the cell header's eight bytes. `pu4Crc32Prev` is the accumulated CRC for the previous cells received for the same message.

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

4.9 BOC Transmission and Reception

This section describes the API functions used to transmit and receive bit-oriented code (BOC). Their tasks include transmitting the specified BOC on the specified HSS link, and reading the BOC received on a HSS link

4.9.1 duplexTxBOC: Transmitting BOC

This function transmits the specified BOC on the specified HSS link. In the case of transmitting a loopback activate-BOC code, the RDIDIS register bit should be set to logic 1 before the transmission. This prevents a pre-emptive remote-defect-indication (RDI) code from being sent.

Valid States `DPX_ACTIVE`

Side Effects None

Prototype `INT4 duplexTxBOC(DUPLEX duplex, UINT1 u1HssLnkId, UINT1 u1Code)`

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

`u1HssLnkId`: HSS link identifier. Valid identifiers are `DPX_RXD1` and `DPX_RXD2`.

`u1Code`: BOC to be transmitted. Valid BOCs are:

- 000000b (RDI)
- 000001b (loopback activate)
- 000010b (loopback deactivate)
- 000011b (remote reset activate)
- 000100b (remote reset not activate)
- 010001b to 111110b (defined by you)
- 111111b (idle code)

Outputs

None

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_INVALID_LNK_ID` (invalid link ID)

`DPX_ERR_INVALID_BOC` (invalid BOC)

4.9.2 duplexRxBOC: Reading from Received BOC

This function can read BOC received on a HSS link.

Valid States

`DPX_ACTIVE`

Side Effects

This function reads from the receive-BOC status register. The application should call this function inside the `indDuplexRxBOC` indication-callback function. This function clears the status bits (`IDLEI` and `BOCI`) in the BOC status register.

Prototype

```
INT4 duplexRxBOC(DUPLEX duplex, UINT1
u1HssLnkId, UINT1 *pu1Code)
```

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

`u1HssLnkId`: HSS link identifier. Valid identifiers are `DPX_RXD1` and `DPX_RXD2`.

Outputs

`pu1Code`: Pointer to BOC to be received. Valid BOCs are:

- 000000b (RDI)
- 000001b (loopback activate)
- 000010b (loopback deactivate)
- 000011b (remote reset activate)
- 000100b (remote reset deactivate)
- 010001b to 111110b (defined by you)
- 111111b (idle code)

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_INVALID_LNK_ID` (invalid link ID)

`DPX_ERR_INVALID_BOC` (invalid BOC)

4.9.3 duplexSetAutoRDITx: Transmitting Remote-Defect Indication Code Words

Enables/disables the automatic transmission of an RDI code word on the specified HSS link.

Valid States

`DPX_INIT, DPX_ACTIVE`

Side Effects

None

Prototype

```
INT4 duplexSetAutoRDITx(DUPLEX duplex, UINT1
u1HssLnkId, UINT1 u1DisableFlg)
```

Inputs	`duplex`: Pointer to DDB that contains device context information maintained by the driver
	`u1HssLnkId`: HSS link identifier. Valid identifiers are `DPX_RXD1` and `DPX_RXD2`.
	`u1DisableFlg`: 1 enables auto transmission of RDI. 0 disables auto transmission of RDI.
Outputs	None
Return Codes	`DPX_SUCCESS`
	`DPX_ERR_INVALID_DEVICE` (invalid device handle)
	`DPX_ERR_INVALID_STATE` (invalid device state)
	`DPX_ERR_INVALID_LNK_ID` (invalid link ID)

4.9.4 duplexSciAnyPhyGetConfig: Getting SCI-PHY/Any-PHY Configuration Information

This function retrieves the contents of the S/UNI-DUPLEX SCI-PHY/Any-PHY configuration registers. It can retrieve the value of individual configuration registers. Alternatively, it can retrieve the entire configuration register set with one call.

Valid States	`DPX_INIT, DPX_ACTIVE`
Side Effects	None
Prototype	`INT4 duplexSciAnyPhyGetConfig(DUPLEX duplex, eDPX_SCI_ANY_PHY_REG eSciAnyPhyRegId, sDPX_SCI_ANY_PHY_REGS *psSciAnyPhyRegs)`

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

`eSciAnyPhyRegId`: Specifies the register containing the value to be retrieved. It can be one of:

- `DPX_SCI_ANY_PHY_EXT_ADDR_MATCH`
- `DPX_SCI_ANY_PHY_EXT_ADDR_MASK`
- `DPX_SCI_ANY_PHY_OUT_ADDR_MATCH`
- `DPX_SCI_ANY_PHY_INP_CFG_1`
- `DPX_SCI_ANY_PHY_INP_CFG_2`
- `DPX_SCI_ANY_PHY_ICA_ENBL_LSB`
- `DPX_SCI_ANY_PHY_ICA_ENBL_2`
- `DPX_SCI_ANY_PHY_ICA_ENBL_3`
- `DPX_SCI_ANY_PHY_ICA_ENBL_MSB`
- `DPX_SCI_ANY_PHY_OUT_CFG`
- `DPX_SCI_ANY_PHY_OUT_POLL_RNG`
- `DPX_ALL_PHY_REGS`

Note: All configuration registers can be retrieved at once using `DPX_ALL_PHY_REGS`

Outputs

`psSciAnyPhyRegs`: Contents of the specified SCI-PHY/Any-PHY registers output by this function

These contents are valid only if the function returns `DPX_SUCCESS`. Also, the only fields in this structure that are valid are those that have been requested using the input parameter, `eSciAnyPhyRegId`.

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_INVALID_REG_ID` (invalid register ID)

4.9.5 duplexSciAnyPhySetConfig: Configuring HSS-Links

This function configures and modifies the contents of the specified HSS-link's configuration registers. It can set the value of individual configuration registers. Alternatively, it can set the entire configuration register set with one call.

Valid States DPX_INIT, DPX_ACTIVE

Side Effects None

Prototype

```
INT4 duplexSciAnyPhySetConfig(DUPLEX duplex,
eDPX_SCI_ANY_PHY_REG eSciAnyPhyRegId,
sDPX_SCI_ANY_PHY_REGS *psSciAnyPhyRegs)
```

Inputs

duplex: Pointer to DDB that contains device context information maintained by the driver.

eSciAnyPhyRegId: Specifies the register containing the value to be set; can be one of:

- DPX_SCI_ANY_PHY_EXT_ADDR_MATCH
- DPX_SCI_ANY_PHY_EXT_ADDR_MASK
- DPX_SCI_ANY_PHY_OUT_ADDR_MATCH
- DPX_SCI_ANY_PHY_INP_CFG_1
- DPX_SCI_ANY_PHY_INP_CFG_2
- DPX_SCI_ANY_PHY_ICA_ENBL_LSB
- DPX_SCI_ANY_PHY_ICA_ENBL_2
- DPX_SCI_ANY_PHY_ICA_ENBL_3
- DPX_SCI_ANY_PHY_ICA_ENBL_MSB
- DPX_SCI_ANY_PHY_OUT_CFG
- DPX_SCI_ANY_PHY_OUT_POLL_RNG
- DPX_ALL_PHY_REGS

Note: All configuration registers can be set at once using DPX_ALL_PHY_REGS.

psSciAnyPhyRegs: Contents of the specified SCI-PHY/Any-PHY registers that this function will set. These contents are valid only if the function returns DPX_SUCCESS. Also, only those fields of this structure are valid that have been requested using the input parameter, eSciAnyPhyRegId.

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_INVALID_REG_ID` (invalid register ID)

4.10 Clocked Serial-Data Interface Functions

The clocked serial-data interface functions perform the following tasks:

- Reads from transmit and receive serial-channel context bytes
- Writes to transmit and receive serial-channel context bytes
- Enables and disables automatic reset of the HCS error-count register

4.10.1 duplexRxSerChnlReadReg: Reading from Receive Serial-Channel Context Bytes

This function indirectly reads a receive serial-channel context byte.

Valid States `DPX_INIT, DPX_PRESENT`

Side Effects None

Prototype

```
INT4 duplexRxSerChnlReadReg(DUPLEX duplex,
UINT1 u1SerChnlId, eDPX_CLK_SER_REG
eClkSerRegId, UINT1 *pu1RegVal)
```

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

`u1SerChnlId`: Serial channel identifier (0 through 15)

`eClkSerRegId`: Specifies the register containing the value that the function will retrieve. It can be one of the following:

- `DPX_CLK_SER_RX_CHNL_CFG`
- `DPX_CLK_SER_RX_INT_ENBLS`
- `DPX_CLK_SER_RX_INT_STATUS`
- `DPX_CLK_SER_RX_HCS_ERR_CNT`
- `DPX_CLK_SER_LCD_CNT_THRESH`

Outputs

`pu1RegVal`: Contents of the specified clocked-bit serial-interface registers output by this function. These contents are valid only if the function returns `DPX_SUCCESS`.

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_INVALID_CHNL_ID` (invalid serial channel ID)

`DPX_ERR_INVALID_REG_ID` (invalid register ID)

4.10.2 duplexRxSerChnlWriteReg: Writing to Receive Serial-Channel Context Bytes

This function indirectly writes to a receive serial-channel context byte.

Valid States

`DPX_INIT, DPX_PRESENT`

Side Effects

None

Prototype

```
INT4 duplexRxSerChnlWriteReg(DUPLEX duplex,
UINT1 u1SerChnlId, eDPX_CLK_SER_REG
eClkSerRegId, UINT1 u1RegVal)
```

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

`u1SerChnlId`: Serial channel identifier (0 through 15)

`eClkSerRegId`: Specifies the register containing the value that the function will retrieve. It can be one of the following:

- `DPX_CLK_SER_RX_CHNL_CFG`
- `DPX_CLK_SER_RX_INT_ENBLS`
- `DPX_CLK_SER_LCD_CNT_THRESH`

`u1RegVal`: Contents of the specified clocked-bit serial-interface register that this function will set

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_INVALID_CHNL_ID` (invalid serial channel ID)

`DPX_ERR_INVALID_REG_ID` (invalid register ID)

4.10.3 duplexRxSerChnlHCSCntResetEn: Enabling Auto Reset of HCS Error Registers

This function enables or disables automatic reset of the HCS error-count register when an indirect read is initiated.

Valid States

`DPX_INIT, DPX_ACTIVE`

Side Effects

None

Prototype

```
INT4 duplexRxSerChnlHCSCntResetEn(DUPLEX
duplex, UINT1 u1Enable)
```

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

`u1Enable`: If value is 0, the flag enables auto reset. If the value is not 0, the flag disables autoreset.

Return Codes

DPX_SUCCESS

DPX_ERR_INVALID_DEVICE (invalid device handle)

DPX_ERR_INVALID_STATE (invalid device state)

4.10.4 duplexTxSerChnlReadReg: Reading from Transmit Serial-Channel Context Bytes

This function indirectly reads a transmit serial-channel context byte.

Valid States

DPX_INIT, DPX_PRESENT

Side Effects

None

Prototype

```
INT4 duplexTxSerChnlReadReg(DUPLEX duplex,
UINT1 u1SerChnlId, eDPX_CLK_SER_REG
eClkSerRegId, UINT1 *pu1RegVal)
```

Inputs

duplex: Pointer to DDB that contains device context information maintained by the driver

u1SerChnlId: Serial channel identifier (0 through 15)

eClkSerRegId: Specifies the register containing the value that this function will retrieve. Its value can be one of the following:

- DPX_CLK_SER_TX_DATA
- DPX_CLK_SER_TX_SER_FRM_BIT_THRESH

Outputs

pu1RegVal: Contents of the specified clocked-bit serial-interface register output by this function. These contents are valid only if the function returns DPX_SUCCESS

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_INVALID_CHNL_ID` (invalid serial channel ID)

`DPX_ERR_INVALID_REG_ID` (invalid register ID)

4.10.5 duplexTxSerChnlWriteReg: Writing to Transmit Serial-Channel Context Bytes

This function indirectly writes to a transmit serial-channel context byte.

Valid States

`DPX_INIT, DPX_PRESENT`

Side Effects

None

Prototype

```
INT4 duplexTxSerChnlWriteReg(DUPLEX duplex,
UINT1 u1SerChnlId, eDPX_CLK_SER_REG
eClkSerRegId, UINT1 u1RegVal)
```

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

`u1SerChnlId`: Serial channel identifier (0 through 15)

`eClkSerRegId`: Specifies the register containing the value that this function will retrieve. It can be one of the following:

- `DPX_CLK_SER_TX_DATA`
- `DPX_CLK_SER_TX_SER_FRM_BIT_THRESH`

`u1RegVal`: Contents of the specified clocked-bit serial-interface register that this function will set

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

`DPX_ERR_INVALID_CHNL_ID` (invalid serial channel ID)

`DPX_ERR_INVALID_REG_ID` (invalid register ID)

4.11 Statistics Collection

This section describes the API functions used to collect statistics about the device's HSS links. Their tasks include:

- Accumulating the received-cell count and header-check sequence (HCS) cell-error count for a specified HSS link
- Accumulating the transmitted-cell count for a specified HSS link
- Reading all the cell counts (transmit and receive) for all the HSS links of the specified device
- Retrieving and resetting the statistical counts maintained by the driver

4.11.1 duplexGetHssLnkRxCounts: Accumulating Counts for Received Cells

This function accumulates the counts for received cells and errored HCS cells for a specified HSS link (RXD1 or RXD2). It triggers an update of the receive HSS cell-counter registers and the receive-HSS HCS error-count register. It then reads the contents of these registers and returns the values read to the application. To maintain a steady count, without overflow, of received cells and HCS cell errors, the application should call this function at least every 30 seconds.

Valid States

`DPX_ACTIVE`

Side Effects

You should not use this function at the same time (in periodic polling fashion) as `duplexGetAllHssLnkCounts` because both functions trigger updates to the receive counters.

Prototype

```
INT4 duplexGetHssLnkRxCounts(DUPLEX duplex,
UINT1 u1HssLnkId, UINT4 *pu4RxCells, UINT4
*pu4HcsErrs)
```

Inputs	`duplex`: Pointer to DDB that contains device context information maintained by the driver
	`u1HssLnkId`: HSS link identifier. Valid identifiers are `DPX_RXD1` and `DPX_RXD2`.
Outputs	`pu4RxCells`: Count of cells received
	`pu4HcsErrs`: Count of errored HCS-cells received
Return Codes	`DPX_SUCCESS`
	`DPX_ERR_INVALID_DEVICE` (invalid device handle)
	`DPX_ERR_INVALID_STATE` (invalid device state)
	`DPX_ERR_INVALID_LNK_ID` (invalid link ID)

4.11.2 duplexGetHssLnkTxCounts: Accumulating Counts for Transmitted Cells

This function accumulates the counts for transmitted cells for a specified HSS link (TXD1 or TXD2). It triggers an update of the transmit HSS cell-counter registers. It then reads the contents of these registers and returns the values read to the application. To maintain a steady count, without overflow, of transmitted cells, the application should call this function at least every 30 seconds.

Valid States	`DPX_ACTIVE`
Side Effects	You should not use this function at the same time (in periodic polling fashion) as `duplexGetAllHssLnkCounts` because both functions trigger updates to the transmit counters.
Prototype	`INT4 duplexGetHssLnkTxCounts(DUPLEX duplex, UINT4 *pu4TxCells)`
Inputs	`duplex`: Pointer to DDB that contains device context information maintained by the driver
Outputs	`pu4TxCells`: Count of cells transmitted

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

4.11.3 duplexGetAllHssCounts: Accumulating Counts for All Cells

This function reads all the cell counts (transmit and receive) for all the serial links of the specified S/UNI-DUPLEX device. This function triggers an update to the RXD1 and RXD2 receive and transmit counters by writing a dummy value to the load performance meters register. It then reads the counters of all the serial links and returns the contents to the calling function.

To maintain a steady count of cells received, cells transmitted, and HCS errored cells on a per-link basis for all the serial links, and to avoid overflow, the application should call this function at least every 30 seconds.

Valid States

`DPX_ACTIVE`

Side Effects

You should not use this function at the same time (in periodic polling fashion) as `duplexGetHssLnkRxCounts` and `duplexGetHssLnkTxCounts` because both functions trigger updates to the same counters.

Prototype

```
INT4 duplexGetAllHssCounts(DUPLEX duplex,
sDPX_HSS_CNTS *psHssCnts)
```

Inputs

`duplex`: Pointer to DDB that contains device context information maintained by the driver

Outputs

`psHssCnts`: Contains the RXD1 and RXD2 cells received, errored received cells, and transmitted cells

Return Codes

`DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

`DPX_ERR_INVALID_STATE` (invalid device state)

4.11.4 duplexGetStatisticCounts: Retrieving Driver Statistical Counts

This function retrieves the statistical counts maintained by the driver. It contains the counts for events and interrupts of the S/UNI-DUPLEX device since the last call to reset statistic counts.

Valid States All states except `DPX_EMPTY`

Side Effects None

Prototype `INT4 duplexGetStatisticCounts(DUPLEX duplex, sDPX_STAT_COUNTS *psStatCounts)`

Inputs `duplex`: Pointer to DDB that contains the count information maintained by the driver

Outputs `psStatCounts`: Contains statistical counts of events and interrupts

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

4.11.5 duplexResetStatisticCounts: Resetting Driver Statistical Counts

This function resets the statistical counts maintained by the driver.

Valid States All states except `DPX_EMPTY`

Side Effects None

Prototype `INT4 duplexResetStatisticCounts(DUPLEX duplex)`

Inputs `duplex`: Pointer to DDB that contains the count information maintained by the driver

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INVALID_DEVICE` (invalid device handle)

4.12 Indication Callbacks

The DPR uses indication callback functions to notify the application of events in the S/UNI-DUPLEX device and driver. You must implement these functions to work within the inter-task communication and scheduling capabilities of your RTOS. Typically, the callback functions will run in the context of the DPR, not in the context of the application. Therefore, these functions must be non-blocking. They should use RTOS-based inter-task notification to pass callback information safely from the DPR to the application task.

4.12.1 indDuplexNotify: Notifying the Application of Significant Events

This indication function notifies the application about the occurrence of a significant event in the hardware or the driver software. The `duplexDPR` function calls this function. This function should be non-blocking. Typically, the indication function sends a message to another task with the event identifier and other context information. The task that receives this message can then process this information according to the system requirements.

Prototype `VOID indDuplexNotify(USR_CTXT usrCtxt, sDPX_IND_BUF *pIndBuf)`

Inputs `usrCtxt`: Context information (maintained by your system) for the device

`pIndBuf`: Information regarding the indication. It consists of an event identifier that identifies the reported event. Uniquely supplemental information about the event. The application should use `duplexReturnIndBuf` to free the indication context structure.

Outputs None

Return Codes None

4.12.2 indDuplexRxBOC: Notifying the Application of Received BOC

This indication function notifies the application about the reception of a valid BOC. The duplexDPR function calls this function. This function should be non-blocking.

Prototype `VOID indDuplexRxBOC(USR_CTXT usrCtxt, sDPX_IND_BUF *pIndBuf)`

Inputs `usrCtxt`: Context information (maintained by your system) for the device

`pIndBuf`: Information regarding the indication. It consists of:

- `u1HssLnkId`: HSS link that received the BOC.
- `u1BOC`: BOC received. It can be one of the following:
  - 000000b (RDI)
  - 000001b (loopback activate)
  - 000010b (loopback deactivate)
  - 000011b (remote reset activate)
  - 000100b (remote reset deactivate)
  - 010001b to 111110b (defined by you)
  - 111111b (idle code)

The application should use `duplexReturnIndBuf` to free the indication context structure.

Outputs None

Return Codes None

4.12.3 indDuplexRxCell: Notifying the Application of Ready Extract-Cell-FIFOs

This indication function notifies the application of the reception of cells in the microprocessor extract cell FIFOs. The `duplexDPR` function calls this function. This function should be non-blocking. Typically, the indication function sends a message to another task with the event identifier and other context information. The task that receives this message can then extract the received cells using `duplexCheckExtractFifos` and `duplexExtractCell`.

Prototype

```
VOID indDuplexRxCell(USR_CTXT usrCtxt,
sDPX_IND_BUF *pIndBuf)
```

Inputs `usrCtxt`: Context information (maintained by your system) for the device

`pIndBuf`: Information regarding the indication. Currently, the driver does not use it, so the driver passes a null pointer for now.

Outputs None

Return Codes None

5 REAL-TIME-OS INTERFACE FUNCTIONS

The driver's RTOS interface module provides functions and macros that let the driver use RTOS services. The S/UNI-DUPLEX driver requires the following RTOS services:

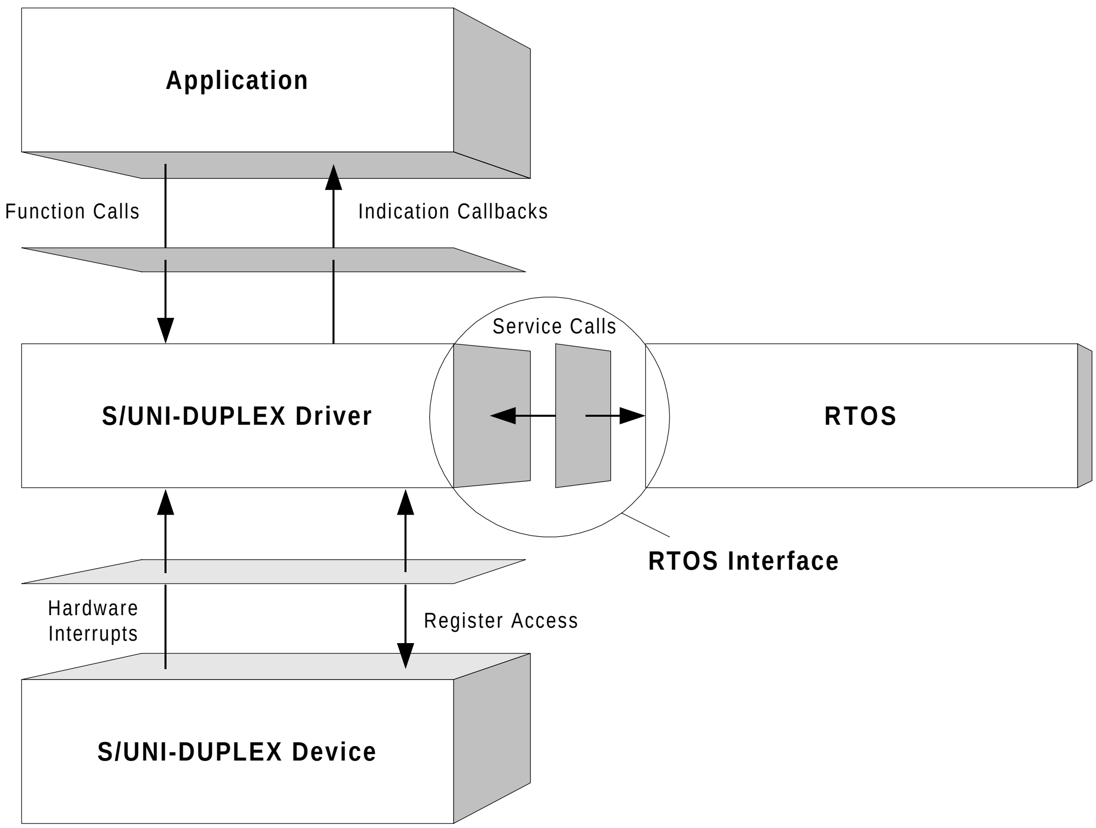
- Memory: Allocate and deallocate
- Interrupts: Install and remove
- Preemption: Enable and disable

The driver may also require the following additional RTOS services depending on how you customize the code (for example, the ISR, the DPR, and so on). These services are:

- Timers: Create, delete, start and abort
- Tasks: Spawn and delete
- Message queues: Create and destroy queues, send and receive messages

Figure 8 illustrates the external interfaces defined for the S/UNI-DUPLEX driver.

Figure 8: Real-Time OS Interface



5.1 Memory Allocation and Deallocation

This section describes the RTOS interface functions used to allocate and deallocate memory.

5.1.1 sysDuplexMemAlloc: Allocating Memory

This macro allocates a specified number of bytes.

Prototype `#define sysDuplexMemAlloc(nbytes) malloc(nbytes)`

Inputs `nbytes`: Number of bytes to be allocated

Outputs None

Return Codes Pointer to first byte of allocated memory

NULL pointer (memory allocation failed)

5.1.2 sysDuplexMemFree: Deallocating Memory

This macro deallocates memory allocated by `sysDuplexMemAlloc`.

Prototype
```
#define sysDuplexMemFree(pu1First)
free(pu1First)
```

Inputs `pu1First`: Pointer to first byte of the memory region being deallocated

Outputs None

Return Codes None

5.2 Buffer Management

This section describes the RTOS interface functions used to manage buffers for the DPR. Their tasks include getting a buffer for saving the context information for the indication callbacks, and returning the buffer after the application has received the context information.

5.2.1 duplexGetIndBuf: Getting DPR Buffers

This function gets a buffer that saves the context information for the indication callbacks called by the DPR.

Prototype `sDPX_IND_BUF *duplexGetIndBuf(VOID)`

Inputs None

Outputs None

Return Codes Pointer to indication context buffer

NULL pointer (buffer unavailable)

5.2.2 duplexReturnIndBuf: Returning DPR Buffers

This function returns the indication context buffer after the DPR has received the context information.

Prototype `VOID duplexReturnIndBuf(sDPX_IND_BUF *pBuf)`

Inputs `pBuf`: Pointer to indication context structure

Outputs None

Return Codes None

5.3 Timer Operations

This section describes the RTOS interface function used to suspend a task for a specified period.

5.3.1 sysDuplexDelayFn: Delaying Functions

This function suspends execution of the calling function’s task for a specified number of milliseconds.

Prototype `VOID sysDuplexDelayFn(UINT4 u4Msecs)`

Inputs `u4Msecs`: Delay (in milliseconds)

Outputs None

Return Codes None

5.4 Semaphore Operations

This section describes the RTOS interface macros used to manage semaphores. Their tasks include:

- Creating a new mutual-exclusion semaphore
- Deleting a specified semaphore
- Taking and giving semaphores

5.4.1 sysDuplexSemCreate: Creating Semaphores

This macro creates a new mutual-exclusion semaphore.

Prototype	`#define sysDuplexSemCreate() semMCreate()`
Inputs	None
Outputs	None
Return Codes	semaphore ID

5.4.2 sysDuplexSemDelete: Deleting Semaphores

This macro deletes a specified semaphore.

Prototype	`#define sysDuplexSemDelete(semId) semDelete(semId)`
Inputs	semaphore ID
Outputs	None
Return Codes	None

5.4.3 sysDuplexSemTake: Taking Semaphores

This macro takes a semaphore.

Prototype	`#define sysDuplexSemTake(semId) semTake(semId)`
Inputs	semaphore ID
Outputs	None
Return Codes	None

5.4.4 sysDuplexSemGive: Giving Semaphores

This macro gives a semaphore.

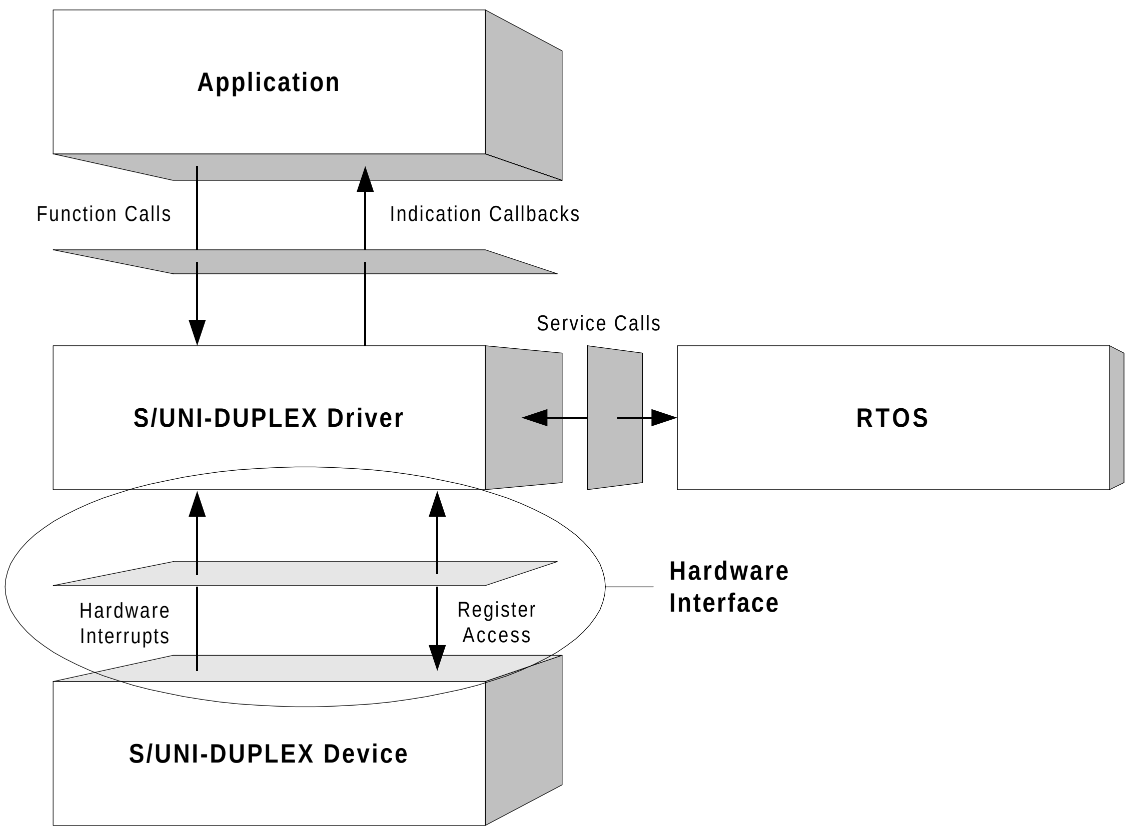
Prototype	`#define sysDuplexSemGive(semId) semGive(semId)`
Inputs	semaphore ID
Outputs	None
Return Codes	None

6 HARDWARE INTERFACE FUNCTIONS

The S/UNI-DUPLEX hardware interface provides functions and macros that read from and write to S/UNI-DUPLEX device-registers. The hardware interface also provides a template for an ISR that the driver calls when the device raises a hardware interrupt. You must modify this function based on the interrupt configuration of your system.

Figure 9 illustrates the external interfaces defined for the S/UNI-DUPLEX driver.

Figure 9: Hardware Interface



6.1 Device Register Access

This section describes the hardware interface functions used to read from and write to S/UNI-DUPLEX device registers. Their tasks include reading and writing the contents of a specific address. It also includes getting the base address of the new device so that the driver can access the device register map to control it.

6.1.1 sysDuplexRawRead: Reading from Register Address Locations

This low-level system-specific macro reads the contents of a specific register-address location. You should define this to reflect your system's addressing logic.

Prototype `#define sysDuplexRawRead(addr, val)`

Inputs `addr`: Address location to be read

Outputs `val`: Value read

6.1.2 sysDuplexRawWrite: Writing to Register Address Locations

This low-level system-specific macro writes the contents of a specific register-address location. You should define this macro to reflect your system's addressing logic.

Prototype `#define sysDuplexRawWrite(addr, val)`

Inputs `addr`: Address location to write

`val`: Value to be written

Outputs None

6.1.3 sysDuplexDeviceDetect: Getting Device Base Addresses

This function uses user context information to detect new S/UNI-DUPLEX devices. The `duplexAdd` API function calls it. This function's implementation is system specific.

Prototype

```
INT4 sysDuplexDeviceDetect(DPX_USR_CTXT usrCtxt,
VOID **ppSysInfo, UINT4 *pu4BaseAddr)
```

Inputs `usrCtxt`: Context information (maintained by your system) for the device

Outputs `pu4BaseAddr`: Base address of device

`ppSysInfo`: Pointer to a system information buffer, which contains system specific information

Return Codes `DPX_SUCCESS`

`DPX_DEVICE_NOT_DETECTED`

6.2 Interrupt Servicing

This section describes the hardware interface functions used to provide hardware interrupt servicing. They install and remove the interrupt handlers and DPRs for the S/UNI-DUPLEX devices. These functions depend on whether you implement the driver in interrupt mode or polling mode. In interrupt mode, their tasks include:

- Installing and removing the system-dependent interrupt-handler function (`sysDuplexIntHandler`) and the DPR function (`sysDuplexDPRTask`), creating a communication channel between the two, and adding the device to a list of devices for which interrupts will be serviced
- Removing the specified device from the list of devices for which interrupt processing will be done
- Calling `duplexISR` for each device for which interrupt processing is enabled
- Retrieving interrupt status information saved for it by the `sysDuplexIntHandler` function, and calling the `duplexDPR` function for the appropriate device

In polling mode, these functions' tasks include:

- Spawning and removing the `sysDuplexDPRTask` function
- Adding the device to a list of devices that need polling
- Polling the S/UNI-DUPLEX device for interrupt status information and processing the interrupt status

The S/UNI-DUPLEX driver provides a function called `duplexISR` that checks if there are any valid interrupt conditions present for a specified device. This function can be used by a system-specific interrupt-handler function to service interrupts raised by S/UNI-DUPLEX devices.

The low-level interrupt handler function that traps the hardware interrupt and calls `duplexISR` is system and RTOS dependent. Therefore, it is outside the scope of the driver. As a reference, this manual provides an example implementation of such an interrupt handler (see `sysDuplexIntHandler`) as well as installation and removal functions (see `sysDuplexIntInstallHandler` and `sysDuplexIntRemoveHandler`). You can customize these example implementations as per your specific requirements.

6.2.1 duplexISR: Registering Interrupt Statuses

This function reads the top-level interrupt-status registers of the interrupting device. If there are any bits set in these registers, this function returns a value greater than zero. If there are no bits set, this function returns a zero. This function is invoked by the system-specific interrupt-handler function, `sysDuplexIntHandler`.

Note: In polling mode, the driver does not use this function.

Valid States	`DPX_ACTIVE`
Side Effects	If the function returns with a non-zero value (meaning interrupt conditions have been detected), then all device interrupts are disabled.
Prototype	`UINT4 duplexISR(DUPLEX duplex)`
Inputs	`duplex` : Pointer to DDB that contains device context information maintained by the driver
Outputs	None
Return Codes	= 0 (no valid interrupt conditions detected)
	> 0 (at least one valid interrupt condition detected)

6.2.2 duplexDPR: Processing Interrupts

This function performs the following tasks:

- Reads the device interrupt-status registers
- Clears the interrupt conditions
- Invokes user-defined callback functions that perform system-specific processing based on the interrupt conditions detected

The system-specific DPR-task function, `sysDuplexDPRTask`, invokes this function.

Valid States `DPX_ACTIVE`

Side Effects Enables device interrupts after processing all the existing interrupt conditions

Prototype `VOID duplexDPR(DUPLEX duplex)`

Inputs `duplex`: Pointer to DDB that contains device context information maintained by the driver

Outputs None

Return Codes None

6.2.3 sysDuplexIntInstallHandler: Installing Interrupt Service Functions

In interrupt mode, this function installs `sysDuplexIntHandler` in the processor vector table, spawns the `sysDuplexDPRTask` function as a task, and creates a communication channel (for example, a message queue) between the two. In addition, it adds the S/UNI-DUPLEX device to a list of devices that need interrupt servicing.

In polling mode, this function spawns the `sysDuplexDPRTask` function. This function periodically polls the device for interrupts and services the interrupts. It also adds the S/UNI-DUPLEX device to a list of devices that need polling services.

Prototype `INT4 sysDuplexIntInstallHandler(DUPLEX duplex)`

Inputs `duplex`: Pointer to device context information

Outputs None

Return Codes `DPX_SUCCESS`

`DPX_ERR_INT_ALREADY`

`DPX_ERR_INT_INSTALL`

6.2.4 sysDuplexIntRemoveHandler: Removing Interrupt Service Functions

In interrupt mode, this function removes the specified device from the list of devices that need interrupt processing. If this is the last active device, the function deletes the `sysDuplexDPRTask` and associated message queue. It also removes the `sysDuplexIntHandler` function from the processor's interrupt-vector table.

In polling mode, this function removes the specified device from the list of devices that need polling services. If this is the last active device, this function deletes `sysDuplexDPRTask`.

Prototype	`VOID sysDuplexIntRemoveHandler(DUPLEX duplex)`
Inputs	`duplex`: Pointer to device context information
Outputs	None
Return Codes	None

6.2.5 sysDuplexIntHandler: Calling duplexISR

In interrupt mode, this function calls `duplexISR` for each device with interrupt processing enabled. The driver calls this function when one or more S/UNI-DUPLEX devices interrupt the microprocessor. If `duplexISR` detects at least one valid pending interrupt condition, then this function queues the interrupt context information for later processing by `sysDuplexDPRTask`.

In polling mode, this function is not used.

Prototype	`sysDuplexIntHandler(INT4 Irq)`
Inputs	`Irq`: IRQ number of interrupt
Outputs	None
Return Codes	None

6.2.6 sysDuplexDPRTask: Calling duplexDPR

In interrupt mode, the driver spawns this function as a separate task within the RTOS. It retrieves interrupt status information queued for it by the `sysDuplexIntHandler` function and calls the `duplexDPR` function for the appropriate device.

In polling mode, the driver spawns this function as a separate task within the RTOS. It periodically calls the `duplexDPR` function for each active device.

Prototype	`VOID sysDuplexDPRTask(VOID)`
Inputs	None
Outputs	None
Return Codes	None

7 PORTING DRIVERS

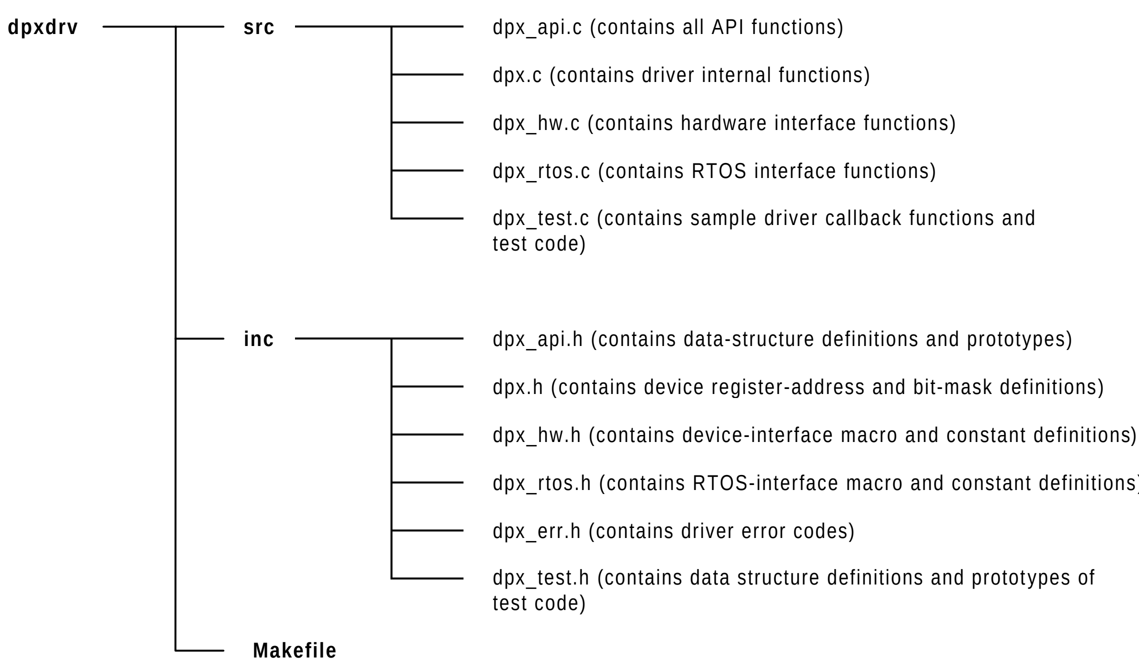
This section outlines how to port the S/UNI-DUPLEX device driver to your hardware and OS platform.

Note: Because each platform and application is unique, this manual can only offer guidelines for porting the S/UNI-DUPLEX driver.

7.1 Driver Source Files

The C source files listed in Figure 7-1 contain the code for the S/UNI-DUPLEX driver. You may need to modify the code or develop additional code. The code is in the form of constants, macros, and functions. For the ease of porting, the code is grouped into source files (`src`) and include files (`inc`). The `src` files contain the functions and the `inc` files contain the constants and macros.

Figure 10: Driver Source Files



7.2 Driver Porting Procedures

The following steps summarize how to port the S/UNI-DUPLEX driver to your platform. The following sections describe these steps in more detail.

Note: Because each platform and application is unique, this manual can only offer guidelines for porting the S/UNI-DUPLEX driver.

To port the S/UNI-DUPLEX driver to your platform:

1. Port the driver's OS extensions (page 98):
    - Data types
    - OS specific services
    - Utilities and interrupt services that use OS specific services
2. Port the driver to your hardware platform (page 100):
    - Port the device detection function.
    - Port low-level device read-and-write macros.
    - Define hardware system-configuration constants.
3. Port the driver's application-specific elements (page 102):
    - Define the task-related constants.
    - Code the callback functions.
4. Build the driver (page 103).

7.2.1 Porting Driver OS Extensions

The OS extensions encapsulate all OS specific services and data types used by the driver. The `dpx_rtos.h` file contains data types and compiler-specific data-type definitions. It also contains macros for OS specific services used by the OS extensions. These OS extensions include:

- Task management
- Message queues
- Timers
- Events
- Semaphores

- Memory Management

In addition, you may need to modify functions that use OS specific services, such as utility and interrupt-event handling functions. The `dpx_rtos.c` file contains the utility and interrupt-event handler functions that use OS specific services.

To port the driver's OS extensions:

1. Modify the data types in `dpx_rtos.h`. The number after the type identifies the data-type size. For example, `UINT4` defines a 4-byte (32-bit) unsigned integer. Substitute the compiler types that yield the desired types as defined in this file.

2. Modify the OS specific services in `dpx_rtos.h`. Redefine the following macros to the corresponding system calls that your target system supports:

Service Type	Macro Name	Description
Memory	`sysDuplexMemAlloc`	Allocates the memory block
	`sysDuplexMemFree`	Frees the memory block
	`sysDuplexMemCopy`	Copies the memory block from `src` to `dest`
Semaphore	`sysDuplexSemCreate`	Creates the mutually exclusive semaphore
	`sysDuplexSemDelete`	Frees the mutually exclusive semaphore
	`sysDuplexSemGive`	relinquishes the mutually exclusive semaphore
	`sysDuplexSemTake`	Gets the mutually exclusive semaphore

3. Modify the utilities and interrupt services that use OS specific services in the `dpx_rtos.c`. The `dpx_rtos.c` file contains the utility and interrupt-event handler functions that use OS specific services. Refer to the function headers in this file for a detailed description of each of the functions listed below:

Service Type	Function Name	Description
Memory	`sysDuplexMemSet`	Sets each character in the memory buffer
	`duplexGetIndBuf`	Gets a block of memory for the indication buffer
	`duplexReturnIndBuf`	Frees the indication buffer
Timer	`sysDuplexDelayFn`	Sets the task execution delay in milliseconds
Interrupt	`sysDuplexIntInstallHandler`	Installs the interrupt handler for the OS
	`sysDuplexIntRemoveHandler`	Removes the interrupt handler from the OS
	`sysDuplexIntHandler`	Interrupt handler for the S/UNI-DUPLEX device
	`sysDuplexDPRTask`	Deferred interrupt-processing routine (DPR)

7.2.2 Porting Drivers to Hardware Platforms

This section describes how to modify the S/UNI-DUPLEX driver for your hardware platform.

Before you build the driver, ensure that you port the driver's OS extensions (page 98).

To port the driver to your hardware platform:

1. Modify the device detection function in the `dpx_hw.c` file. The function `sysDuplexDeviceDetect` is implemented for a PCI platform. Modify it to reflect your specific hardware interface. Its purpose is to detect a S/UNI-DUPLEX device based on a user-context input parameter. It returns two output parameters:
   - The base address of the S/UNI-DUPLEX device
   - A pointer to the system-specific configuration information
2. Modify the low-level device read/write macros in the `dpx_hw.h` file. You may need to modify the raw read/write access macros (`sysDuplexRawRead` and `sysDuplexRawWrite`) to reflect your system's addressing logic.
3. Define the hardware system-configuration constants in the `dpx_hw.h` file. Modify the following constants to reflect your system's hardware configuration:

#define	Description	Default
`DPX_MEM_ADDR_RANGE`	The assigned address memory range for each S/UNI-DUPLEX device. Your system's memory map determines it.	0x800
`DPX_ADAPTER_MAX_UNITS`	The maximum number of S/UNI-DUPLEX cards allowed in the system Note: The DSLAM architecture allows up to 16 S/UNI-DUPLEX cards.	7
`DPX_ADAPTER_MAX_DEVS`	The maximum number of S/UNI-DUPLEX devices on each card	1

7.2.3 Porting Driver Application-Specific Elements

Application specific elements are configuration constants used by the API for developing an application. This section describes how to modify the application specific elements in the S/UNI-DUPLEX driver.

Before you port the driver's application-specific elements, ensure that you:

1. Port the driver's OS extensions (page 98).
2. Port the driver to your hardware platform (page 100).

To port the driver's application-specific elements:

1. Define the following driver task-related constants for your OS-specific services in file `dpx_rtos.h`:

#define	Description	Default
`DPX_DPR_TASK_PRIORITY`	Deferred Task (DPR) task priority	85
`DPX_DPR_TASK_STACK_SZ`	DPR task stack size, in bytes	4096
`DPX_POLLING_DELAY`	Constant used in polling task mode, this constant defines the interval time in millisecond between each polling action	10
`DPX_TASK_SHUTDOWN_DELAY`	Delay time in millisecond. When clearing the DPR loop active flag in the DPR task, this delay is used to gracefully shutdown the DPR task before deleting it.	10
`DPX_MAX_DPR_MSGS`	The queue message depth of the queue used for pass interrupt context between the ISR task and DPR task	10
`DPX_MAX_IND_BUFSZ`	Maximum indication buffer size in bytes	53
`DPX_MAX_NUM_DEVS`	The maximum number of S/UNI-DUPLEX devices in the system (from 1 to 128)	7

2. Code the callback functions according to your application. There are four sample callback functions in the `dpx_test.c` file. You can use these callback functions or you can customize them before using the driver. The driver will call these callback functions when an event occurs on the device. These functions must conform to the following prototypes:

   - `VOID indDuplexNotify(DPX_USR_CTXT usrCtxt, sDPX_IND_BUF *psIndCtxt)`
   - `VOID indDuplexRxBOC(DPX_USR_CTXT usrCtxt, sDPX_IND_BUF *psIndCtxt)`
   - `VOID indDuplexCell(DPX_USR_CTXT usrCtxt, sDPX_IND_BUF *psIndCtxt)`
   - `UINT1 pCellTypeFn(UINT1 *pu1Hdr, UINT4 *pu4Crc32Prev)`

7.2.4 Building Drivers

This section describes how to build the S/UNI-DUPLEX driver.

Before you build the driver, ensure that you:

1. Port the driver’s OS extensions (page 98).
2. Port the driver to your hardware platform (page 100).
3. Port the driver’s application-specific elements (page 102).

To build the driver:

1. Modify the makefile’s compile-switch flag `DPX_CSW_INTERRUPT_MODE`. Set it to one for interrupt mode or zero for polling mode.
2. Set the makefile’s compile-switch flag `CSW_PV_FLAG` to zero. This disables the test code specific to product verification.
3. Ensure that the directory variable names in the makefile reflect your actual driver and directory names.
4. Compile the source files and build the S/UNI-DUPLEX API driver library using your make utility.

5. Link the S/UNI-DUPLEX API driver library to your application code.

APPENDIX: CODING CONVENTIONS

This section describes the coding and naming conventions used in the implementation of the driver software. This section also describes the variable types.

Definition of Variable Types

The following table describes the variable types used by the S/UNI-DUPLEX driver.

Table 16: Definition of Variable Types

Type	Description
UINT1	unsigned integer, 1 byte
UINT2	unsigned integer, 2 bytes
UINT4	unsigned integer, 4 bytes
INT1	signed integer, 1 byte
INT2	signed integer, 2 bytes
INT4	signed integer, 4 bytes
VOID	void
DPX_USR_CTXT	void *, pointer to user maintained device context
DUPLEX	void *, pointer to driver maintained device context

Naming Conventions

The names for variables, functions, and macros (but not constants) include prefixes that indicate their type. Variable, function, and macro names that contain multiple words have the first letter of each word capitalized.

Variables

The following table describes the prefixes used for the driver's variables.

Table 17: Variable Naming Conventions

Variable Type	Prefix	Example

UINT1
UINT2
UINT4
	`u1`
	`u2`
	`u4`
		`u1Flag`
		`u2Code`
		`u4Val`

INT1
INT2
INT4
	`i1`
	`i2`
	`i4`
		`i1Flag`
		`i2Code`
		`i4Val`

Structure Variable	`s`	`sCellHdr`
Enumerated Type	`e`	`eHssRegId`

Pointers	`p`	`pu1Flag`
		`pi4Val`
		`psCellHdr`
		`peHssRegId`

Pointer to a Pointer	`pp`	`ppu1Flag`
		`ppi4Val`
		`ppsCellHdr`
		`ppeHssRegId`

Functions and Macros

The following table describes the prefixes used for the driver's functions and macros.

Table 18: Function and Macro Naming Conventions

Function Type	Prefix	Example Name
API Functions	`duplex`	`duplexAdd`
Indication Functions	`indDuplex`	`indDuplexRxCell`
System-Specific Functions and Macros	`sysDuplex`	`sysDuplexIntHandler`

Definable Constants

You can define some constants using the “`#define`” command. These constants have names that are composed of all uppercase letters with underscores separating multiple words. An example is `DPX_NUM_HSS_LNKS`.

ACRONYMS

API: Application programming interface

DDB: Device data block

BOC: Bit oriented code

DPR: Deferred interrupt-processing routine

GDD: Global driver database

HCS: Header check sequence

HSS link: High-speed serial link

ISR: Interrupt service routine

RTOS: Real-time operating system

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